JENNIFER M. GRANHOLM
GOVERNOR

STATE OF MICHIGAN
DEPARTMENT OF LABOR & ECONOMIC GROWTH
LANSING

KEITH W. COOLEY
DIRECTOR

ELECTRICAL ADMINISTRATIVE BOARD
DEPARTMENT OF LABOR & ECONOMIC GROWTH
BUREAU OF CONSTRUCTION CODES

Conference Room 3
Okemos Office Building
2501 Woodlake Circle, Okemos, Michigan

AGENDA

August 3, 2007
9:30 a.m.

1. Call to order and determination of quorum

2. Approval of Minutes – June 1, 2007 (Pages 3-5)

3. Document E-07-11 Examination Applicants (Pages 6-33)

   E-07-11A Applicants who passed the contractor exam May 2007.
   E-07-11B Applicants who passed the master exam May 2007.
   E-07-11C Applicants who passed the journey exam May 2007.
   E-07-11D Applicants who passed the contractor exam June 2007.
   E-07-11E Applicants who passed the master exam June 2007.
   E-07-11F Applicants who passed the journey exam June 2007

4. Document E-07-12 Electrical Inspector Registration Applicants. (Page34)

5. Document E-07-13 Appeal by Cochran Electric vs. City of Jackson. (Pages 35-71)

6. Document E-07-14 Approval of program hours for Kellogg Community College. (Pages 72-172)

7. Document E-07-15 Appeal by Randal E. Cole to take the journey exam. (Pages 173-194)

8. Old business –

9. New Business -

10. Legislative Update -

11. Public Comment -

12. Next Meeting –October 5, 2007

13. Adjournment

"The meeting site is accessible, including handicapped parking. Individuals attending the meeting are requested to refrain from using heavily scented personal care products, in order to enhance accessibility for everyone. People with disabilities requiring additional accommodations in order to participate in the meeting should contact Carol Raylean at (517) 241-9320 at least 10 work days before the event."

JENNIFER M. GRANHOLM
GOVERNOR

STATE OF MICHIGAN
DEPARTMENT OF LABOR & ECONOMIC GROWTH
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DEPARTMENT OF LABOR & ECONOMIC GROWTH

BUREAU OF CONSTRUCTION CODES
Conference Room 3
2501 Woodlake Circle
Okemos, Michigan 48864

MINUTES

June 1, 2007
9:30 a.m.

MEMBERS PRESENT

Mr. Ernest Harju
Mr. Clark Justin
Mr. Mark Bauer
Mr. Richard Long
Ms. Thelma Dobson
Mr. David Bushouse

MEMBERS ABSENT

Mr. Frank Donovan
Mr. Rowland Cornish III
Mr. Joseph Reyes

MICHIGAN DEPARTMENT OF LABOR & ECONOMIC GROWTH PERSONNEL ATTENDING

Mr. Virgil Monroe, Chief, Electrical Division
Ms. Carol Raylean, Division Secretary
Mr. Dan O'Donnell, Assistant Chief, Electrical Division
Mr. Mark Sisco, Deputy Director

OTHERS IN ATTENDANCE

Rich Hutchins, Daimler Chrysler
Larry Houle, ACH LLC
Don Drob, Ford Mtr Co, Romeo Engine
Dave Flack, MDOC
Phil Barnett, IBEW
Paul Waug, IAEI, RECI
Paul DuPuis, Local 557

1. **CALL TO ORDER AND DETERMINATION OF QUORUM**

The meeting was called to order at 9:30 a.m. by Mr. Mark Bauer, Vice-Chair. Roll was taken and it was determined a quorum was present.

2. **APPROVAL OF MINUTES**

The minutes of the April 20, 2007 meeting was reviewed. A **MOTION** was made by Mr. Long and **SECONDED** by Mr. Justin to recommend approval of the minutes as written. **MOTION CARRIES.**

3. **LICENSE REVIEW** – Document E-07-09

A **MOTION** was made by Ms. Dobson and **SECONDED** by Mr. Long to take Documents E-07-09A, through E-07-09C, as a whole, and recommend approval. **MOTION CARRIES.**

4. **ELECTRICAL INSPECTOR REGISTRATION** – Document E-07-10

A **MOTION** was made by Ms. Dobson and **SECONDED** by Mr. Long for approval. **MOTION CARRIES.**

5. **OLD BUSINESS** – Document E-07-08 Product approval for Ozilite ACL110WMT, Automatic Cigarette Lighter for use by the Department of Corrections. The unit, manufactured in Australia, will eliminate the use of matches and lighters; however, it does not have testing laboratory approval as there are no standards for the product. The equipment has not been approved as a unit. It is on a timer 10 seconds on and 10 seconds off and is currently being used in other states, with no history of any problems. Members of the board had reservations on the approval of the cigarette lighter without additional information or certification. Some of the suggestions made were approval by an independent engineering laboratory and a list of the states currently using the unit. A **MOTION** was made by Mr. Long and **SECONDED** by Ms. Dobson requesting Mr. David Flack from the DOC return to the board once this additional information or certification can be provided. **MOTION CARRIES.**

6. **NEW BUSINESS** – A short discussion regarding the decision of the MSEA vs. the Department of Corrections by the Court of Appeals.

7. **LEGISLATIVE UPDATE** - None

8. **PUBLIC COMMENT** - Additional discussion regarding the cigarette lighter.

9. **ADJOURNMENT** – 10:30 a.m.

William F. Donovan, Chair Date

LICENSE REVIEW E-07-11A

August 3, 2007

The Department of Labor & Economic Growth, Electrical Division, has issued licenses to the following applicants who received a passing score for the examination taken in Escanaba in May 2007.

Contractors License

DEAN TIMOTHY P	ESCANABA
GOODMAN REGINALD D	HOLT
HOWELL PHILLIP R	NILES
KIZEWSKI JOHN F	WARREN
KLAUS JEFFERY E	PORT HURON
LLOYD PATRICK M	COMMERCE
LUCHT STEPHANIE M	SHELBY TWP
OLSON RONALD P.	HOUGHTON
SAM CHARLES B	RICHMOND
SKORINA BRAD P	SOUTHGATE

LICENSE REVIEW E-07-11B

August 3, 2007

The Department of Labor & Economic Growth, Electrical Division, has issued licenses to the following applicants who received a passing score for the examination taken in Escanaba in May 2007.

Master Electrician

BERKOMPAS, DALE R	DORR, MI
DOTSON, JASON E	FENTON, MI
DZWIK, ANDREW J	TRAVERSE CITY, MI
GENGLER, DENNIS T	GRAND BLANC MI
HAMMERSTROM, MARTY W	CALOMET, MI
JACOBSON, JOHN E	FLINT, MI
JAMES, BRET D	PARCHMENT MI
NAKHOUL, RIAD	WINDSOR ONTARIO
NEWTON, TIMOTHY E	SAND LAKE, MI
ROEMER, PAUL D	MANISTIQUE, MI
ROMANS, ARTHUR L	IRONWOOD, MI
WOOD, CHRISTOPHER	LAKE ISABELLA, MI

LICENSE REVIEW E-07-11C

August 3, 2007

The Department of Labor & Economic Growth, Electrical Division, has issued licenses to the following applicants who received a passing score for the examination taken in Escanaba in May 2007.

Journey Electrician

ARGALL, SHAWN C	ISHPEMING, MI
BALL, TROY Z	ESSEXVILLE MI
BALLIEN, ASA S	MIDLAND, MI
BELFY, MARC S	CHARLEVOIX, MI
BETSON, MATTHEW R	ST CLAIR SHORES, MI
BOYER, JARRED S	ALANSON, MI
BURDICK, JEFFERY A	PARMA, MI
CARLSON, BRODY LEE	MANISTIQUE, MI
DAVIS, JOHN C	CLINTON TOWNSHIP, MI
FELTER, STEPHEN E	CHARLEVOIX, MI
GALBREATH, CRAIG A	JACKSON, MI
HATFIELD, ERIC P	GRAND LEDGE MI
HONEYSETTE, JAMES J	ALANSON, MI
HOWELL, PHILLIP R	NILES, MI
KASTNER, MICHAEL J	HARPER WOODS, MI
KLOOSTER, CHARLES	CHARLEVOIX, MI
KNIGHT, PATRICK E	ELK RAPIDS, MI
KOHLBECK, DENNIS J	CHARLEVOIX, MI

LICENSE REVIEW E-07-11C

August 3, 2007

The Department of Labor & Economic Growth, Electrical Division, has issued licenses to the following applicants who received a passing score for the examination taken in Escanaba in May 2007.

Journey Electrician

MILLER, JAMES R	EASTPOINTE, MI
PEASE, DANIEL A	PORT HURON, MI
POCHMARA, GARY P	GOODRICH, MI
PORTER, DAVID E	CHATHAM, MI
SELLERS, DAVID J	MT CLEMENS, MI
SNEDDON, ROBERT C	CHESTERFIELD, MI
STRONG, CHRIS A	KINGSFORD, MI
TERRES, STEVEN F	ISHPEMING, MI
WICHMAN, MATTHEW E	EATON RAPIDS, MI
WILLIAMS, ANTHONY J	STERLING HEIGHTS MI

LICENSE REVIEW E-07-11D

August 3, 2007

The Department of Labor & Economic Growth, Electrical Division, has issued licenses to the following applicants who received a passing score for the examination taken in Okemos in June 2007.

Contractors License

BASSETT JEFFREY S	GOBLES
BERLIN DOUGLAS R	GRAND BLANC
BIONDO MICHAEL W	GRANDVILLE
BONZHEIM CHRIS S	WYOMING
BOOTKA KULETTE A	ROSEVILLE
BORCHARDT ROBERT J	BEAVERTON
BOSTROM PAUL M	WILLIAMSTON
BRAUN JEFFREY C	SHELBY TWP
BREDICE CHRIS J	IONIA
BURMAN CHRISTOPHER S	HUDSONVILLE
BUTINA JOSEPH B JR	CLINTON TWP
CARY RYAN D	WESTLAND
CHURCHILL PAUL H	PORT HURON
DUNAJ KENNETH L	MADISON HEIGHTS
FOLEY NEIL F	NOVI
FRANK RANDY W	COLOMA
GEIGER MARK R	HOLLAND
GROSS KENARD JR	MEMPHIS

LICENSE REVIEW E-07-11D

August 3, 2007

The Department of Labor & Economic Growth, Electrical Division, has issued licenses to the following applicants who received a passing score for the examination taken in Okemos in June 2007.

Contractors License

HANSHAW EDWARD K	CLINTON TWP
HARTLEY SCOTT W	JACKSON
HEATH KARL L	JONESVILLE
HENDEE CRAIG J	PORTLAND
HILTON HEATH S	ROCKFORD
JACKSON DAVID W	CHARLESTON
JAKUBOWSKI GARY S	LAKE ORION
KALTZ MATTHEW J	HIGHLAND
KOLAR MICHAEL	TEMPERANCE
KOZAK JOSEPH M	CALEDONIA
KRAUSE CRAIG D	SANDUSKY
LOUWSMA PHILLIP R	ALMONT
LOVE BARBARA K	EAGLE
LOVING ERIC L	REDFORD
MACKALL BURWELL D	HERSEY
MAILLOUX RICHARD P	HOWELL
MARSACK MICHAEL	MACOMB

LICENSE REVIEW E-07-11D

August 3, 2007

The Department of Labor & Economic Growth, Electrical Division, has issued licenses to the following applicants who received a passing score for the examination taken in Okemos in June 2007.

Contractors License

MCDONALD KENNETH L	WATERFORD
MENZIES KEVIN J	WARREN
MUTSCHLER STEVEN K	BYRON CENTER
NARVAB HASSON	WARREN
PRICE KARL W	BARODA
RITTER PHILIP S	JEDDO
ROOSE JOHN	STERLING HEIGHTS
ROSEBOOM JOSHUA M	VICKSBURG
RUEHLE JEFFREY G SR	SYLVANIA
SALTZ ROSS C	ANN ARBOR
SCHMIDT LAWRENCE J	CEDAR SPRINGS
SLAUGHTER JARROD K	DELTON
SMITH GERALD L	TAYLOR
SMITH RICHARD G	TRAVERSE CITY
SWANWICK SHAWN A	KALAMAZOO
VOULGAROPOULOS GEORGIOS	TROY
WATKIN JEFFREY	CHELSEA
WHITTAKER TIMOTHY D	ALBION

LICENSE REVIEW E-07-11D

August 3, 2007

The Department of Labor & Economic Growth, Electrical Division, has issued licenses to the following applicants who received a passing score for the examination taken in Okemos in June 2007.

Contractors License

WOODS CHRISTOPHER C	CASCO
YORK DOUGLAS L	ALLEN PARK

LICENSE REVIEW E-07-11E

August 3, 2007

The Department of Labor & Economic Growth, Electrical Division, has issued licenses to the following applicants who received a passing score for the examination taken in Okemos in June, 2007.

Master Electrician

ABERNATHY, SCOTT D	BROWNSTOWN, MI
ADDINGTON, CASSANDRA	FARMINGTON HILLS, MI
ANDRUS, RAYMOND O	SAND LAKE, MI
ANDRUS, TICE M	WATERFORD, MI
ANKNEY, MICHAEL J	BELLEVUE, MI
ARMATO, MICHAEL A	CORAL, MI
AUITO, RYAN C	CLINTON TWP, MI
BACHMAN, LARRY C	MILAN, MI
BARR, ROBERT L	LAINGSBURG, MI
BARTELDS, SCOTT	HUDSONVILLE, MI
BEAN, MICHAEL A	REDFORD TOWNSHIP, MI
BLASY, BRAD D	MIDLAND, MI
BOERSMA, THOMAS D	LOWELL MI
BRADFIELD, JAMES A	PORTAGE, MI
BRAHIM, MARY A	MACOMB TOWNSHIP, MI
BRANT, RYAN M	FREMONT, MI
BRASILE, CARL	UTICA, MI
BROCKWAY, TIMOTHY JAY	INKSTER, MI
BROGOWSKI III, JOSEPH R	LIVONIA, MI
BROWER, THOMAS	MIDDLEVILLE, MI

LICENSE REVIEW E-07-11E

August 3, 2007

The Department of Labor & Economic Growth, Electrical Division, has issued licenses to the following applicants who received a passing score for the examination taken in Okemos in June, 2007.

Master Electrician

BURR, KENNETH A	GRAND HAVEN MI
BUTCHER, GORDON G	BEAVERTON, MI
CAIRO, ROMEO G	WESTLAND, MI
CHAPPLE, KYLE W	FENTON, MI
CHARLES, GILBERT D	PINCKNEY, MI
COGSWELL, PETER A	WAYNE, MI
CURRIE, BRYAN D	ST CLAIR, MI
CUSWORTH, ROBERT C	ALGONAC, MI
DALLORSO, MAX W	ROUND ROCK, TX
DEBRINCAT, MICAH J	BELLEVILLE MI
DECKER, WILLIAM J	VICKSBURG, MI
DECORMIER, MICHAEL J	CLINTON MI
DEUR, BRUCE M	NEWAGO, MI
DIFRANKS, JAMES V JR	ROMEO, MI
DORSCH, RUSSELL A	ST CLAIR SHORES, MI
DRENCHEN, CHARLES N II	WEBBERVILLE, MI
DRUMM, RYAN J	LAKE ORION, MI
ECKHOFF, STEVEN J	JENISON, MI
EGGLESTON, FRANK R	MARCELLUS, MI

LICENSE REVIEW E-07-11E

August 3, 2007

The Department of Labor & Economic Growth, Electrical Division, has issued licenses to the following applicants who received a passing score for the examination taken in Okemos in June, 2007.

Master Electrician

ESPOSITO, ANTONIO	MACOMB, MI
FERGUSON, JOEY L	JACKSON, MI
FICKLE, KEN G	QUINCY, MI
FUSON, JACK A	CLARKSTON, MI
GIBBONS, SEAN M	OXFORD, MI
GOSDZINSKI, JOYCE M MI	PLYMOUTH TOWNSHIP,
GRATER, DAVID K	NOVI, MI
GUISGAND JR, CHARLES R	BELLEVILLE, MI
HARTONG, ADAM L	CONSTANTINE, MI
HASTY, DANIEL D	MUSKEGON, MI
HAUTAU, MICHAEL E	COMMERCE TWP, MI
HENDEE, CRAIG J	PORTLAND, MI
HOUSLEY, SCOTT M	ROYAL OAK, MI
HREHA, MICHAEL S	WARREN, MI
HUBER, DAVID B	MACOMB, MI
JUSTICE, JAMES I	QUINCY, MI
JUSTUS, DAVID L	GOODRICH, MI
KALMINK, RANDALL L	ZEELAND, MI
KAROL, MICHAEL S	ROSEVILLE, MI

LICENSE REVIEW E-07-11E

August 3, 2007

The Department of Labor & Economic Growth, Electrical Division, has issued licenses to the following applicants who received a passing score for the examination taken in Okemos in June, 2007.

Master Electrician

KENT, JOSEPH T SR	DEARBORN HEIGHTS, MI
KERN, SCOTT T	REESE, MI
KERSEN, RICHARD W	WALKER, MI
KING, AMY L	MUSKEGON, MI
KINKADE, DANUAL T	LAKE ORION, MI
KLAYO, JEFFREY M	MT CLEMENS, MI
KOLENDA, SCOTT D	BELMONT, MI
KRAUSE, CRAIG D	SANDUSKY, MI
LANGENDERFER, JEREMY P	ANN ARBOR, MI
LEE, MICHAEL R	WESTLAND, MI
LORIO, MATTHEW J	CLINTON TWP, MI
LUCAS, BRADLEY D	JONESVILLE, MI
MARCHAND, JOHN A	ALLEN PARK, MI
MARTIN, JASON W	CARO, MI
MASSEY-WORTHY, MEKELOA A	MACOMB, MI
MAURER, GERALD M	DEARBORN HEIGHTS MI
MCGUIRE, CHRISTOPHER B	TRAVERSE CITY, MI
MOONEY, DUANE A	LANSING, MI
MUTSCHLER, RICHARD J	SARANAC, MI
NICHOLS, JEFFREY S	LERESCO MI

LICENSE REVIEW E-07-11E

August 3, 2007

The Department of Labor & Economic Growth, Electrical Division, has issued licenses to the following applicants who received a passing score for the examination taken in Okemos in June, 2007.

Master Electrician

NORROW, ANTHONY J	CLAWSON, MI
O'CONNOR, DAVID B	TAYLOR MI
ORKISZ, NORBERT L	SOUTH LYON, MI
PAGE III, LAWRENCE C	CHESTERFIELD, MI
PEREZ, MARIO W	WYANDOTTE, MI
PETERS, DERON	EATON RAPIDS, MI
PIKE, QUENTIN K	ROCKFORD, MI
POREMBA, JASON A	TRENTON, MI
POUGET, JEFFREY A	REDFORD, MI
RAMOTOWSKI, CHRISTOPHER	STERLING HEIGHTS, MI
RATHBUN, DANIEL S	PRUDENVILLE, MI
RICHARDSON, NATHAN G	ANN ARBOR, MI
ROSS, JEFFREY A	HOWELL, MI
SALTERS, SCOTT	PLAINWELL, MI
SAWLE, ROBERT A	FENTON, MI
SEAGLUND, KENNETH M	PONTIAC, MI
SEALE, RODNEY A	LIVONIA, MI
SHEMANSKI, MICHAEL J	WALKER MI
SKORINA, BRAD P	SOUTHGATE, MI

LICENSE REVIEW E-07-11E

August 3, 2007

The Department of Labor & Economic Growth, Electrical Division, has issued licenses to the following applicants who received a passing score for the examination taken in Okemos in June, 2007.

Master Electrician

STAELGRAEVE, JONATHON M	MONROE, MI
STEELE, JEFFERY E JR	WHITE CLOUD, MI
STOFFLET, ERIC E	YPSILANTI, MI
SUNNOCK, JEREMY P	OTSEGO, MI
SUTTON, RONALD E	MACOMB, MI
TERZANO, LOUIS J	WIXOM, MI
THEBOLT, BRIAN K	SOUTHGATE, MI
TINSKEY, JOHN A	HOWELL, MI
TOCCO, ANTHONY C	CLINTON TWP, MI
TROWER, DAVID M	PETOSKEY, MI
VANDER HELM, STEVE J	ALLENDALE, MI
VANDERHOOF, TIMOTHY R	GALESBURG, MI
VANDERPLOEG, PAUL J JR	MORLEY, MI
VOISINET, WILLIAM D	LAINSBURG, MI
WEINING, DOUGLAS A	HOWARD CITY, MI
WILSON, JASON W	HOWELL, MI
WITTIG, KATHLEEN A	WASHINGTON, MI
YORK, RAYMOND A	BRIGHTON, MI
YOUNG, ROBERT F	SANFORD, MI
YOUNGS, RICHARD L	EAST TAWAS, MI

LICENSE REVIEW E-07-11E

August 3, 2007

The Department of Labor & Economic Growth, Electrical Division, has issued licenses to the following applicants who received a passing score for the examination taken in Okemos in June, 2007.

Master Electrician

ZUIDEMA, DUANE A	HOPKINS, MI
ZUVERINK, SCOTT A	HUDSONVILLE, MI

LICENSE REVIEW E-07-11F

August 3, 2007

The Department of Labor & Economic Growth, Electrical Division, has issued licenses to the following applicants who received a passing score for the examination taken in Okemos in June 2007.

Journey Electrician License

ADAMS, BRIAN S	CADILLAC, MI
ALDRICH, NICHOLAS L	JACKSON, MI
ALSTERMARK, ANTHONY MICHAEL	REDFORD, MI
BABICH JR, JOHN	BRIGHTON, MI
BALCOM, CARL L	LAPEER, MI
BALDERSON, BRADLEY S	WOODLAND, MI
BELLEW, JASON A	ROSEVILLE, MI
BERBERICH, MARK R	OAKLAND, MI
BOLLA, RICHARD W	TRENTON, MI
BOLTZ, BRADLEY R	LIVONIA, MI
BORON, STEVEN D	WESTLAND, MI
BOYD, MICHAEL R	LINCOLN PARK, MI
BRADSHAW, JEANNETTE L	WATERFORD, MI
BRIGMON, SCOTT A	REDFORD TWP, MI
BROWN, MICHAEL J	EASTPOINTE, MI
BRUNING, RUSSELL A	TROY, MI
BRYANT, LANDON J	WARREN, MI
BUSS, PAUL P JR	WARREN, MI

LICENSE REVIEW E-07-11F

August 3, 2007

The Department of Labor & Economic Growth, Electrical Division, has issued licenses to the following applicants who received a passing score for the examination taken in Okemos in June 2007.

Journey Electrician License

CALDER, WILLIAM R	TAYLOR, MI
CAMPBELL, CURTIS II	KINDE, MI
CARLISLE, JASON R	JACKSON, MI
CARLISLE, SCOTT D	GRAND HAVEN, MI
CARLSON, LUKAS A	KALAMAZOO, MI
CARRIVEAU, PATRICK J	SPRUCE, MI
CLACK, RANDALL T	FERNDALE, MI
CLARK, TIMOTHY M	CADILLAC, MI
CLICK, MAURICE D	WYANDOTTE, MI
COLLINS, TEDD B	PALMER, MI
CONNOR, MATTHEW T	WALKER, MI
COOK, ROBERT J	WARREN, MI
COWLES, GERALD M	LAKE CITY, MI
CRANDALL, CHRISTOPHER M	STERLING HEIGHTS, MI
CRAWFORD, GARY D	CEDAR SPRINGS, MI
CRIDER, MICHAEL	GRANDVILLE, MI
CUSTER, BRIAN H	CLAWSON, MI

LICENSE REVIEW E-07-11F

August 3, 2007

The Department of Labor & Economic Growth, Electrical Division, has issued licenses to the following applicants who received a passing score for the examination taken in Okemos in June 2007.

Journey Electrician License

DAVENPORT, RODGER C	WEST BLOOMFIELD, MI
DAVIS JR, GLENN A	YPSILANTI MI
DEGRAAF, JEFF R	JENISON, MI
DEGRYSE, MICHAEL C	WILLIS, MI
DELAURIER, JON P	MT CLEMENS, MI
DEMARA, TONY W	CLINTON TWP, MI
DEVLIEGER JR, DONALD J	DORR, MI
DEVLIN, DENNIS M	NORTHVILLE, MI
DIBIASE, DANIEL P	MONROE, MI
DIEHL, TROY L	WESTLAND, MI
DINNAN, JAMES P	BURTON, MI
DONEGAN, NOEL H	STERLING HEIGHTS, MI
DORAN, DAVID A	BAY CITY, MI
DOWD, KENNETH A	BENTLEY, MI
DULIMBA, KENNETH P	WYANDOTTE, MI
DUNCAN, JONATHAN E	TROY, MI
DUNITHAN, JUSTIN T	PORTAGE, MI
DUNNE, ROBERT P	DEARBORN, MI

LICENSE REVIEW E-07-11F

August 3, 2007

The Department of Labor & Economic Growth, Electrical Division, has issued licenses to the following applicants who received a passing score for the examination taken in Okemos in June 2007.

Journey Electrician License

EATON, NATHAN S	TOLEDO OH
EGGERS, BRIAN D	HASTINGS, MI
ELLIS, DOUGLAS H	WYOMING, MI
FALES, DAVID A	STANDISH, MI
FALLAT, MARK A	MACOMB, MI
FALZETTA, VINCENT M	COMMERCE TWP, MI
FENNEMA, BRUCE	HUDSONVILLE, MI
FERRIS, CHAD T	FARMINGTON HILLS, MI
GABOR, BRADFORD T	STERLING HEIGHTS, MI
GALBRAITH, ERIC J	ST CLAIR SHORES, MI
GOODSELL, PAUL S	OWOSSO, MI
GOSS, KEVIN A	ROSEVILLE, MI
GOSUR, ERIK L	FARMINGTON HILLS, MI
GRAHAM, JOHN F	HANOVER, MI
GUENTHER, WILLIAM C	STERLING HEIGHTS, MI
GUEST, JEREMY K	BELLEVILLE, MI
GUTUSKEY, STEVEN J	FARMINGTON HILLS, MI

LICENSE REVIEW E-07-11F

August 3, 2007

The Department of Labor & Economic Growth, Electrical Division, has issued licenses to the following applicants who received a passing score for the examination taken in Okemos in June 2007.

Journey Electrician License

HACKENBERG, DONALD D III	RAVENNA MI
HAISMA, SCOTT F	COMSTOCK PARK, MI
HALL, GLENN E	NEWAYGO, MI
HAMILTON, MICHAEL D	NASHVILLE, MI
HAMMOND, RICHARD W	JACKSON, MI
HANEWACKER, SCOTT D	WATERFORD, MI
HARTMAN, JAMES S	DEARBORN, MI
HARTMAN, MATTHEW A	BROWNSTOWN, MI
HEMENWAY, COREN L	THREE RIVERS MI
HEUSEL, BRIAN C	SALINE, MI
HIGBEE, KENNETH L	NEW BALTIMORE, MI
HUBER, JEFFERY JOSEPH	SHEPHERD MI
HUFF, PATRICK D	BANGOR, MI
JACKSON, JASON L	ST CLAIR SHORES, MI
JAMES, JUSTIN D	ST CHARLES, MI
JEAN, GREGORY M	ROCKWOOD, MI
JOHNSTON, JENNIFER M	EAST JORDAN, MI
JONES, BRADLEY E	WHITE LAKE, MI

LICENSE REVIEW E-07-11F

August 3, 2007

The Department of Labor & Economic Growth, Electrical Division, has issued licenses to the following applicants who received a passing score for the examination taken in Okemos in June 2007.

Journey Electrician License

KAYL, WILLIAM R	HAZEL PARK, MI
KEARNS, PETER M	PORTAGE, MI
KEENEY, AMY L	WYOMING, MI
KING, DANIEL J	LONSTANTINE, MI
KING, MARCELLOUS	COMSTOCK PARK, MI
KOEBEL, KIM	FARMINGTON HILLS, MI
KOTCHER, RONALD J JR	STERLING HEIGHTS, MI
KRAUSE, JOHN	EASTPOINTE, MI
KRUMM, BRIAN R	OTSEGO MI
KUDLA, JASON J	WARREN, MI
LANDEO, ROBINSON A	MOUNT CLEMENS, MI
LANHAM, JASON M	TAYLOR, MI
LEES, CHRISTOPHER W	ROSEVILLE, MI
LESZCZYNSKI, RONALD S	PLYMOUTH, MI
LITTLE, RICKY R	DEXTER, MI
LODHOLTZ, WALTER R	CHASE, MI
LYZENGA, BRIAN M	WYOMING, MI

LICENSE REVIEW E-07-11F

August 3, 2007

The Department of Labor & Economic Growth, Electrical Division, has issued licenses to the following applicants who received a passing score for the examination taken in Okemos in June 2007.

Journey Electrician License

MAITLAND, STEVEN J	ROSEVILLE, MI
MALINIAK, DANIEL M	GREENWOOD, MI
MALLORY, GREG H	CLINTON TOWNSHIP, MI
MANN, JOHN R	SAGINAW, MI
MARKUS, ERIC G	CURTICE, OH
MARLETT, SCOTT J	JACKSON, MI
MARTER, KURT D	MEMPHIS MI
MARTIN, MATTHEW J	KOKOMO, IN
MARTINI, ANDY J	WESTLAND, MI
MASON, SCOTT ALAN	DEARBORN, MI
MCCLAIN, GEORGE C	STERLING HEIGHTS, MI
MCKELVEY, CALEB J	PINCKNEY, MI
MCKENZIE, GARY J	WILLIS, MI
MCKEONE, SEAN M	LINCOLN PARK, MI
MEHL, RICKY S	ALGONAC, MI
MERANTZA, MICHAEL J	ROCHESTER HILLS, MI
MOORE, ROGER W	SHEPHERD MI
MORRIS, JASON M	NORTH MUSKEGON, MI

LICENSE REVIEW E-07-11F

August 3, 2007

The Department of Labor & Economic Growth, Electrical Division, has issued licenses to the following applicants who received a passing score for the examination taken in Okemos in June 2007.

Journey Electrician License

MORRISON, BRANDON J	FRASER, MI
NEEB, ANDREW E	JACKSON, MI
NELSON, BRETT R	ADRIAN, MI
NICHOLS, DONALD J	BELLEVILLE, MI
NUTT, ANTHONY J	HANOVER, MI
O'MARA, ERIC J	LAKE ODESSA, MI
OSBORN, CHAD S	DIMONDALE, MI
PACA, DENIS	EAST LANSING, MI
PAGENKOPF, HAROLD H	WESTLAND, MI
PARIS, MARK T	LINDEN, MI
PARLOVE, PATRICK M	ST CLAIR SHORES, MI
PAULUS, MATTHEW D	PETOSKEY, MI
PEARCE, TROY W	MACOMB, MI
PERKINS, NATASHA M	STERLING HEIGHTS, MI
PETCH, BRIAN J JR	ATHENS, MI
PFEIFER, ADAM G	HOWARD CITY, MI
PICKERING, OSCAR WILLIAM	BEAVERTON MI

LICENSE REVIEW E-07-11F

August 3, 2007

The Department of Labor & Economic Growth, Electrical Division, has issued licenses to the following applicants who received a passing score for the examination taken in Okemos in June 2007.

Journey Electrician License

PIORUNEK, JOHN M	NORTH BRANCH, MI
PIZZIMENTI, DONALD A	CARLETON, MI
POPE, ALAN R	COLEMAN, MI
POTTS, JASON L	YALE, MI
POUPORE, ALAN G	BYRON CENTER, MI
PRASKI, JEFFREY	RICHMOND, TWP
PRATER, JOSHUA E	MACOMB, MI
PREISLER, BRIAN J	SPRING LAKE, MI
PULLING, TARA L	PORTLAND, MI
RABURN, EARNEY J	S ROCKWOOD, MI
RAKES, ELBERT S	WIXOM, MI
RANDLES, KENNETH A	SOUTHGATE, MI
REMER, WILLIAM R	GARDEN CITY, MI
RENNOLDS, JOEL W	GROSSE POINTE WOODS, MI
RICE, LEVI K	MASON, MI
RICHARDSON, DENNIS J	LANSING, MI
RICKARD, RONALD W	MILAN, MI
RITCHIE, KURT J JR	NEW BOSTON, MI

LICENSE REVIEW E-07-11F

August 3, 2007

The Department of Labor & Economic Growth, Electrical Division, has issued licenses to the following applicants who received a passing score for the examination taken in Okemos in June 2007.

Journey Electrician License

RIVARD, JEFFREY A	BAY CITY, MI
RODGERS, GREGORY A	MASON, MI
RODRIGUEZ, TODD D	TECUMSEH MI
ROTTIERS, PAUL R	BIRCH RUN, MI
SAGE, JEROMY S	FLINT, MI
SCHMUKER, CHRISTOPHER M	ROCKFORD, MI
SCHOENBECK, SHAWN	HOWELL, MI
SCHOMAKER, STEVE E	MERRILL, MI
SEEM, JOHN M	PORTAGE MI
SERAFIN, WESTON A	HORTON, MI
SHAW, JUSTIN J	TOLEDO, OH
SHOEMAKER, ROBERT A	ORTONVILLE, MI
SITZER, KYLE E	LOWELL, MI
SMITH, BRYAN J	ROCHESTER HILLS, MI
SMITH, JEFFREY B	CARELTON, MI
SNIDER, CORBETT A	HARTLAND, MI
SPILLER, DEON J	REDFORD, MI

LICENSE REVIEW E-07-11F

August 3, 2007

The Department of Labor & Economic Growth, Electrical Division, has issued licenses to the following applicants who received a passing score for the examination taken in Okemos in June 2007.

Journey Electrician License

SPRIGGS, JAMES L	LINWOOD, MI
STECKOWSKI, ROBERT M	NORTHVILLE, MI
STEEVES, GEORGE W	HOWELL, MI
STICE, JEFFREY A	OSTSEGO, MI
STOVER, PAUL C	GRAND RAPIDS MI
SUMMERVILLE, JUSTIN H	ST CLAIR SHORES, MI
TACEY, BEN B	ESSEXVILLE, MI
TAYLOR, ROBERT J	TAYLOR, MI
TELNERS, EDMUND J	DEARBORN HEIGHTS, MI
THOMPSON, THOMAS D	WHITMORE LAKE, MI
TRANTHAM, TERRY B	LIVONIA, MI
TYLER, ERIC M	UTICA, MI
URBANCZYK, SCOTT A	WARREN, MI
URSO, SAMUEL D	COMMERCE TOWNSHIP, MI
VANDER HAAR, KEITH A	HOLLAND, MI
VANDERZEE, NICHOLAS L	GRAND RAPIDS, MI
VASAS, SHAUN E	CHELSEA, MI
VOGELAR, DEREK D	SAND LAKE MI

LICENSE REVIEW E-07-11F

August 3, 2007

The Department of Labor & Economic Growth, Electrical Division, has issued licenses to the following applicants who received a passing score for the examination taken in Okemos in June 2007.

Journey Electrician License

VOWLES, CHRISS R	WESTLAND, MI
WAGNER, TODD A	GRAND RAPIDS, MI
WALKER, STEVEN J	VASSAR, MI
WALLACE, TY M	TOLEDO, OH
WALTERS, JASON D	LAPORTE, IN
WARD, ZACHARY J	COMSTOCK PARK, MI
WATTS, TY	WEBBERVILLE, MI
WEBER, CHAD M	CEDAR SPRINGS, MI
WHYTE, ROBERT G	REDFORD, MI
WILCOX, ROBERT H	CANTON, MI
WILLFORD, JERRY E	GLADWIN, MI
WILLIAMS, DAVID L	KIMBALL, MI
WILLIAMSON, THOMAS R	LAKE ORION, MI
WILSON, JOHN	BELLEVILLE, MI
WISHOWSKI, KIRK	NUMCA, MI
WOLF, JOHN J	HOWELL, MI
WOODARD, ZACHARY	CLARKSTON, MI

LICENSE REVIEW E-07-11F

August 3, 2007

The Department of Labor & Economic Growth, Electrical Division, has issued licenses to the following applicants who received a passing score for the examination taken in Okemos in June 2007.

Journey Electrician License

YADEN, JOHN D	HOWELL, MI
YARBROUGH, BRADLEY A	LAKE ORION, MI
ZIMMER, DANIEL J	VASSAR, MI
ZIRKLE, BRANDON	SOUTH LYON, MI

DOCUMENT #E-07-12

ELECTRICAL INSPECTORS

08/03/07 eab
09/12/07 ccc

COURTER, Craig W.
Master License #6204589 (1/1983)
Additional Inspector
City of Charlotte – Eaton County

STOUDT, John C.
Master License #6208897 (1/1996)
Additional Inspector
City of Walled Lake – Oakland County

WESOLEK, James P.
Master License #6209616 (8/1999)
Additional Inspector
Taymouth Township – Saginaw County

MICHIGAN CONSTRUCTION CODE COMMISSION
DEPARTMENT OF LABOR & ECONOMIC GROWTH
BUREAU OF CONSTRUCTION CODES
P.O. BOX 30254
LANSING, MI 48909
(517) 241-9328

APPEAL DOCKET NO: CCC-ELEC 07-004

Petitioner, Cochran Electric Co.

VS

Respondent, City of Jackson

NOTICE OF HEARING

Date: August 3, 2007
Time: 9:30 A.M.
Location: 2501 Woodlake Circle
Okemos, MI 48864
Conference Room 3, Floor 1

Pursuant to the authority contained in 1972 PA 230, Section 16, as amended, the Michigan Construction Code Act (MCLA 125.1516):

A hearing will be held in response to the request of Cochran Electric Co, dated 04/27/2007, to appeal for relief from the requirements of MEC, Section 445.18. In the event that a party in this hearing intends to offer additional exhibits, transmit one (1) copy to each party listed on the attached proof of service and (1) copy to this office with proof of service.

All parties are expected to be prepared to present competent evidence regarding the disputed issues. This hearing will be conducted in accordance with procedures applicable to contested cases and 1969 PA 306 of the Administrative Procedures Act.

Exhibits:

Exhibit 1 – Application for Construction Code Appeal
Exhibit 2 – State of Facts and Reasoning
Exhibit 3 – Building Code Board of Examiners and Appeals-Notice of Hearing
Exhibit 4 – Letter from Frank Donovan to Members of the Building Code Board of Appeals
Exhibit 5 – Previous (Exhibit A), Application for Variance and Documentation provided by Albert Kahn Assoc. Inc.

Exhibit 6 – Previous (Exhibit B), Violation Notice issued to Cochran Electric
Exhibit 7 – Previous (Exhibit C), National Electrical Code Article 445.18
Exhibit 8 – Previous (Exhibit D), NEC Article 100 Definition of a Disconnecting Means
Exhibit 9 – Previous (Exhibit E), Email from Mr. Wroblewski
Exhibit 10 – Previous (Exhibit F), NEC Article 445.13
Exhibit 11 – Generator Operations
Exhibit 12 – Building Code Round of Appeals

MICHIGAN CONSTRUCTION CODE COMMISSION

Virgil Monroe
Chief, Electrical Division

Date July 19, 2007

PROOF OF SERVICE

I, Carol Raylean, hereby state, to the best of my knowledge, information and belief, a copy of the foregoing document was served upon all parties and/or attorneys of record in this matter by Inter-Departmental mail to those parties employed by the State of Michigan and by UPS/Next Day Air, facsimile, e-mail and/or by mailing same to them via first class mail and/or certified mail, return receipt requested, at their respective addresses as disclosed by the file on the 19th day of July 2007.

Carol Raylean
Electrical Division

Cochran Electric Co.
2103 S. Jackson St.
Jackson MI 49203

City of Jackson
161 W. Michigan Ave.
Jackson MI 49201

RECEIVED APR 27 2007 By

Application for Construction Code Appeal

Michigan Department of Labor & Economic Growth
Bureau of Construction Codes
P.O. Box 30255, Lansing, MI 48909
517-241-9328
www.michigan.gov/bcc

Agency Use Only: **CCC-ELEC-07-004**

Application Fee: $500.00

Authority: 1972 PA 230 Completion: Voluntary Penalty: Appeal will not be heard	The Department of Labor and Economic Growth will not discriminate against any individual or group because of race, sex, religion, age, national origin, color, marital status, disability, or political beliefs. If you need help with reading, writing, hearing, etc., under the Americans with Disabilities Act, you may make your needs known to this agency.

Note: The applicant is responsible for all fees applicable to this application.

FACILITY INFORMATION

FACILITY NAME	ADDRESS
Foote Hospital	205 N. East Av

NAME OF CITY, VILLAGE OR TOWNSHIP IN WHICH FACILITY IS LOCATED

☐ City ☐ Village ☐ Township Of: Jackson

COUNTY: Jackson

BUILDING DATA

GROSS FLOOR AREA

☐ New Building ☐ Addition ☒ Alteration ☐ Repair

CLASSIFICATION PER BUILDING CODE

Building Use: Hospital Construction Type: No. of Occupants: Area/Floor: No. of Floors:

PERMIT HOLDER

NAME (Company or Individual)	CONTACT PERSON	TELEPHONE NUMBER (Include Area Code)
Cochran Electric Co.	Ronald Cochran	517-784-7106

ADDRESS	CITY	STATE	ZIP CODE	FAX NUMBER (Include Area Code)
2103 S. Jackson St.	Jackson	MI	49203	517-784-9801

BUILDING OWNER

NAME (Company or Individual)	CONTACT PERSON	TELEPHONE NUMBER (Include Area Code)
Foote Hospital	Harold Baker	517-788-4834

ADDRESS	CITY	STATE	ZIP CODE	FAX NUMBER (Include Area Code)
205 N. East Av	Jackson	MI	49202	517-789-5931

BUILDING PERMIT AUTHORITY

ENFORCING AGENCY	NAME OF BUILDING OFFICIAL	TELEPHONE NUMBER (Include Area Code)
City of Jackson	Frank Donovan	517-788-4012

ADDRESS	CITY	ZIP CODE	FAX NUMBER (Include Area Code)
161 W. Michigan Av	Jackson	49201	517-768-5832

SUMMARY OF APPEAL

CODE UNDER WHICH APPEAL IS SOUGHT

☐ Building (141) ☒ Electrical (116) ☐ Mechanical (131) ☐ Plumbing (99)

CODE SECTION(S): 445.18

DESIRED RELIEF (State Briefly): Use Paralleling switchgear breaker as disconnect

BASIS OF APPEAL (State Briefly): Engineered System

Provide copies of the following as appropriate (see instructions for number of copies):

- ☑ Statement of Facts and Reasoning
- ☑ Copy of Enforcing Agency Determination
- ☑ Supporting Material
- ☑ Copy of Decision of Local Board of Appeals
- ☑ Transcript of Local Board of Appeals Hearing

APPLICANT (Note: All correspondence will be sent to this address)

NAME OF COMPANY	APPLICANT NAME	SOCIAL SECURITY NUMBER* OR FEIN (REQUIRED)
Cochran Electric Co.	Ronald Cochran	

ADDRESS	CITY	STATE	ZIP CODE	TELEPHONE NUMBER (Include Area Code)
2103 S. Jackson St.	Jackson	MI	49203	517-784-7106

APPLICANT SIGNATURE (Must be an original signature)	DATE	FAX NUMBER (Include Area Code)
Ronald C Cochran	4-24-07	517-784-9801

*This information is confidential. Disclosure of confidential information is protected by the Federal Privacy Act.

BCC-972 (Rev. 12/06) Front

Tran Info#16 12868818-1 04/25/07
CHK#: 20087 Amt: $500.00
COCHRAN ELECTRIC

EXHIBIT 1

Statement of Facts and Reasoning

Foote Hospital revised their emergency power system to meet the needs of their expanding facility.

The new emergency system consists of 3 generators of which one is existing and two are new. These generators are set up for automatic operation through new paralleling switchgrear. The generators and switchgear are located in the same room. Access to that room is restricted to qualified individuals only. Copies of the one-line diagram and generator/paralleling switchgear equipment layout are furnished under the Supporting Material items.

Foote Hospital has an established procedure for Lockout/Tagout. A copy of the procedure is furnished under the Supporting Material items.

A Building Permit was issued by the City Of Jackson, Michigan on April 6, 2006 under number PE060342. The installation was completed as permitted and was inspected on or about October 25, 2006.

The Electrical Inspector for the City of Jackson, Michigan issued a Correction Notice on March 13, 2007 requiring the installation of a disconnecting means on the generators, to comply with Article 445.18 of the 2002 issue of the National Electrical Code.

We believe our design is in compliance with the stated article, for the following reasons:

1. NEC Article 445.18 requires a means for disconnecting the generator.
2. Our design employs a paralleling switchgear installed in the same room with the generators. Each of the generators is connected to the paralleling switchgear via a dedicated, draw-out, lockable breaker.
3. The paralleling switchgear is designed to automatically bring on-line all the generators connected to it, one generator at a time, in a manner that is "electrically" correct and safe. Transfer can not occur prior to a generator's output being synchronized with the paralleling switchgear's bus with regards to voltage and frequency. The need for a circuit breaker to connect each generator's output to the paralleling switchgear's bus is mandatory for the proper operation of the automatic paralleling scheme. A copy of the Sequence of Operations is provided under the Supporting Material items.
4. NEC Article 445.18 requires disconnecting means for the generator. It does not require an additional disconnect at the paralleling switchgear for the same generator. In fact, if a disconnect was installed on the generator, an additional disconnect at the paralleling switchgear would have been totally unnecessary.
5. The reason for using circuit breakers at the paralleling switchgear is stated in Item 3 above. It is logical to try and maximize use of their presence to eliminate unnecessary redundancy, as long as safety is not compromised.
6. It is our interpretation that each lockable breaker in the paralleling switchgear, one for each generator, serves the purpose of the disconnect stated in NEC Article 445.18. It accomplishes the functions called for in the article without compromising safety. It happens to be at a location other than on the generator.

EXHIBIT 2

We do not feel that the location of the disconnect being different than on the generator, but meeting all the conditions we described above, is contrary to NEC requirements. We believe that the disconnect being located at the paralleling switchgear meets the intent of the code. Further, it could be argued that the design provides a somewhat safer condition for personnel working on any of the generators.

1. The breaker in the paralleling switchgear can be padlocked in the open position. This breaker is a draw-out type. Total disconnection is achieved by tripping the breaker open or opening it via its handle, racking the breaker out of the switchgear in the "disconnected" position, and padlocking it open.
2. When one of the generators needs to be repaired or taken off-line for any reason, the generator would be disconnected from the paralleling switchgear by opening a disconnect, if one was located on the generator, and repairs would commence. In the event that the paralleling switchgear is energized while the generator is being repaired (and this would happen if normal power was lost at that time; the remaining generators started, synchronized and went on-line powering the paralleling switchgear's bus), the "line side" stabs of the disconnect located on the generator would become energized by the paralleling switchgear attempting to backfeed the generator. This possibility is eliminated by the breaker located in the paralleling switchgear; the entire feeder cable from the paralleling switchgear to the generator would be taken off-line by opening the breaker. By racking this breaker out to the "disconnected" position the possibility of the feeder cable becoming energized is totally eliminated.

Department of Community Developmen

161 W. Michigan Ave. • Jackson, MI 49201-130
Facsimile (517) 768-583

Administrative Services
(517) 788-4060

Building Inspection
(517) 788-4012

Rehabilitation Services & Informatio
(517) 788-4070

BUILDING CODE BOARD OF EXAMINERS AND APPEALS

NOTICE OF HEARING

Monday, April 9, 2007

COCHRAN ELECTRIC
2103 S JACKSON ST
JACKSON MI 49203

RE: 205 N EAST AVE

Please be advised, and you are hereby notified, that a hearing to consider the appeal application filed with the Inspection Division will be held by the Building Code Board of Appeals in the City Commission Chambers, 161 W Michigan Ave, Jackson, Michigan, on the Second Floor on **04/19/2007, at 1:00 p.m.**

You are hereby invited to **present evidence** at this hearing to show cause why the appeal, as set forth in the original application should be granted.

Sincerely,

Roger Iveson
Chief Building Official
City of Jackson

RI/smp

cc: file copy

EXHIBIT 3

Department of Community Development

161 W. Michigan Avenue • Jackson, MI 49201-1303
Facsimile (517) 780-478

Administrative Services
(517) 788-4060

Building Inspection
(517) 788-4012

Rehabilitation Services & Information
(517) 788-4070

TO: Members of the Building Code Board of Appeals

DATE: April 13, 2007

FROM: Frank Donovan, Electrical Inspector

SUBJECT: Appeal by Cochran Electric of the Correction Notice issued March 13, 2007 for Permit PE060342 Regarding the Generator Disconnecting Means Required by Article 445.18 of the National Electric Code

---

Cochran Electric filed an "Application For Variance" and supporting documentation by Albert Kahn Associates, Inc. on April 3, 2007 for a Correction Notice issued March 13, 2007 (**Exhibit A**):

The supporting documentation contends that the design and installation complies with the National Electric Code (NEC) Article 445.18 and that this installation is not a violation of the code.

1. NEC Article 445.18 requires a means for disconnecting the generator.

2. Our design employs paralleling switchgear installed in the same room with the generators. Each of the generators is connected to the paralleling switchgear via a dedicated, draw-out, lockable breaker.

3. It is our intention that each lockable breaker in the paralleling switchgear, one for each generator, serves the purpose of the disconnect stated in NEC Article 445.18. It accomplishes the functions called for in the article. It happens to be at a location other than at the generator.

We do not feel that the location of the disconnect being different than at the generator is contrary to NEC requirements. We believe that the disconnect being located at the paralleling switchgear meets the intent of the code.

1. The breaker in the paralleling switchgear can be padlocked in the open position. This breaker is a draw-out type. Total disconnection is achieved by tripping the breaker open or opening it via its handle, racking the breaker out of the switchgear in the "disconnected" position, and padlocking it open.

2. When one of the generators needs to be repaired or taken off-line for any reason, the generator would be disconnected from paralleling switchgear by opening a disconnect, if one was located at the generator, and repairs would commence. In the event that the paralleling switchgear is energized while the generator is being repaired (and this would happen if normal power was lost at the time and the remaining generators started and powered the switchgear), the "line side" stabs of the disconnect located at the generator would become

energized by the paralleling switchgear attempting to back feed the generator. This possibility is eliminated by the breaker located in the paralleling switchgear; the entire feeder cable from the switchgear to the generator would be taken off-line by opening the breaker. By racking this breaker out to the "disconnected" position the possibility of the feeder cable becoming energized is totally eliminated.

3. NEC Article 445.18 requires disconnecting means for the generator. It does not require an additional disconnect at the paralleling switchgear for the same generator. In fact, if a disconnect was installed at the generator we would not have provided an additional breaker at the paralleling switchgear. This would have met the letter of the code but in our opinion would not have provided the same level of safety as that afforded by our design.

On March 13, 2007 a violation notice was issued by the City of Jackson to Cochran Electric (**Exhibit B**). In this violation notice, Cochran Electric was notified to install a disconnecting means on the generators to comply with Article 445.18 of the National Electric Code (**Exhibit C**):

> Article 445.18 Generators shall be equipped with a disconnect by means of which the generator and all protective devices and control apparatus are able to be disconnected entirely from the circuits supplied by the generator except where:
>
> (1) The driving means for the generator can be readily shut down; and
> (2) The generator is not arranged to operate in parallel with another generator or other source of voltage.

Article 100, Definitions, defines a Disconnecting means (**Exhibit D**) as:

> A device, or group of devices, or other means by which the conductors of a circuit can be disconnected from their source of supply.

Conclusion

The information contained in the supporting documentation from the architectural firm is compelling and appears reasonable, however this installation does not comply with Article 445.18. Mr. Peter Wroblewski acknowledged in an e-mail (**Exhibit E**) that my interpretation of this code is absolutely correct as I wrote it but he believes this installation meets the intent of the code.

Because the arguments of the architect are reasonable and on the surface appear correct I chose to contact Underwriters Laboratory and The National Fire Protection Association to get their feed back on my interpretation of this article before I wrote a formal notification of the code violation. In my conversations with Underwriters Laboratory and The National Fire Protection Association, both agencies confirmed that the generators must be equipped with a disconnecting means and that the EPO switch and draw-out type circuit breaker located in the paralleling switchgear do not meet the intention Article 445.18.

In Exhibit A, the architect indicates that Article 445.18 requires a means for disconnecting the generator. This is not entirely accurate. Article 445.18 specifically requires generators **to be equipped with a disconnect** for disconnecting the circuits supplied by the generator. Furthermore by definition, a disconnect is a device or group of devices that disconnect conductors from their source of supply, in this case, the generators.

There is one exception to this requirement. A generator is permitted to utilize an emergency stop button to act as the disconnect required by Article 445.18, provided the generator is not arranged to operate in parallel with another generator or other source of voltage. The installation at Foote Hospital has three generators operating in parallel with provisions for a mobile generator to be connected in the future if the need arises, therefore this exception does not apply to this installation.

The EPO switch on the generators is an emergency stop button intended to shut down the generator and open the paralleling switchgear circuit breaker in an emergency situation. This switching procedure disconnects the paralleling switchgear, not the conductors, from the generator as specifically required by Article 445.18.

In the second paragraph numerated 3 of Exhibit A, the architect implies that a disconnect at the generator is redundant to the circuit breaker in the paralleling switchgear. This again is not entirely correct. A disconnecting means on the generator does not eliminate the requirement for the overcurrent protection required by Article 445.13 at the first distribution device containing overcurrent protection (**Exhibit F**). The fact that a draw-out circuit breaker can be considered a disconnect is correct, but the purpose of this circuit breaker is for overcurrent protection of the conductors between the generator and the paralleling switchgear, not as the disconnect required by Article 445.18. If the architect chose to install a circuit breaker as the required disconnect at the generator then additional overcurrent protection would not be required at the paralleling switchgear.

The National Electric Code is a minimum standard for electrical installations. Put another way, it is one step away from being illegal. There are numerous ways to improve on the minimum requirements of the code and the paralleling switchgear equipped with draw-out circuit breakers in conjunction with the disconnect required on the generator is an example of incorporating additional levels of protection for installations in critical locations like this one at Foote Hospital.

The supporting documentation in Exhibit A blends the disconnecting means required in Article 445.18 and overcurrent protection for the conductors from the generator to the first distribution devices containing overcurrent protection required in Article 445.13.

This violation notice is for failure to provide a disconnect at the generator as required by Article 445.18. In this installation the design is lacking the disconnect required on the generators therefore I cannot approve this installation.

Recommendation

It is recommended that Cochran Electric install disconnecting means on the generators in accordance with Article 445.18. of the National Electric Code.

Exhibit A Application for Variance and documentation provided by Albert Kahn Associates, Inc.
Exhibit B Violation Notice issued to Cochran Electric.
Exhibit C National Electric Code Article 445.18.
Exhibit D National Electric Code Article 100 definition of a disconnecting means.
Exhibit E E-mail from Mr. Wroblewski.
Exhibit F National Electric Code Article 445.13.

EXHIBIT A

Application for Variance and Documentation
Provided by Albert Kahn Associates, Inc.

APPLICATION FOR VARIANCE

Receipt # 00003813

Building Code Board of Appeals

RECEIVED
APR 3 - 2007

Chapter 14 - Housing Code

I/We have received the code violation letter issued by the Community Development Department for the below-referenced property and wish to file an appeal for consideration. Please place this request on the agenda for the next possible Building Code Board of Appeals meeting.

FOOTE HOSPITAL
205 N. EAST AVE
PROPERTY ADDRESS

FRANK DONOVAN
INSPECTOR NAME

COCHRAN ELECT.
OWNER/AGENT NAME

2103 S. JACKSON ST
OWNER/AGENT STREET ADDRESS

517 784 7106
TELEPHONE NUMBER

JACKSON MI 49203
CITY/STATE/ZIP CODE

SECTION OF CODE REQUESTING VARIANCE FROM: Appeal decision made by electrical inspector

PROPOSED ALTERNATIVE (Reason for appeal - attach additional sheets if necessary):

The Engineer does not feel the code needs the Disconnects for this system

A LETTER IS ATTACHED.

OWNER/AGENT SIGNATURE: Ronald E Cochran DATE: 4-3-06

Permit # PE0603 42

DO NOT WRITE BELOW THIS LINE - FOR OFFICE USE ONLY

Building Code Board of Appeals Agenda Date: _____

Owner/Agent Notified of Hearing: _____

Variance Approved: _____ Variance Denied: _____

Board Action: _____

Owner/Agent Present at Hearing: _____

Owner/Agent Notified of Board Decision: _____

ALBERT KAHN ASSOCIATES, INC.
PLANNING, DESIGN AND MANAGEMENT

Albert Kahn Building
7430 Second Ave.
Detroit, MI
48202-2798

Phone:
313-202-7000
Fax:
313-202-7001
Email:
aka@akahn.com
Web:
www.albertkahn.com

March 20, 2007

Mr. Ron Cochran
Cochran Electric Company
2103 South Jackson Street
Jackson, Michigan 49203

Re: Foote Hospital
Jackson, Michigan
EMERGENCY DEPARTMENT EXPANSION AND RENOVATIONS
AKA Job No. 2766F

Dear Mr. Cochran,

This is in response to the letter you received from the City of Jackson, Michigan indicating the need for correction to the installation of generators at the Foote Hospital.

The letter indicates that the installation does not meet the requirements of National Electrical Code (NEC) Article 445.18 with regards to the generator disconnect.

We believe our design is in compliance with the stated article, for the following reasons:

1. NEC Article 445.18 requires a means for disconnecting the generator.
2. Our design employs a paralleling switchgear installed in the same room with the generators. Each of the generators is connected to the paralleling switchgear via a dedicated, draw-out, lockable breaker.
3. It is our interpretation that each lockable breaker in the paralleling switchgear, one for each generator, serves the purpose of the disconnect stated in NEC Article 445.18. It accomplishes the functions called for in the article. It happens to be at a location other than at the generator.

We do not feel that the location of the disconnect being different than at the generator is contrary to NEC requirements. We believe that the disconnect being located at the paralleling switchgear meets the intent of the code.

1. The breaker in the paralleling switchgear can be padlocked in the open position. This breaker is a draw-out type. Total disconnection is achieved by tripping the breaker open or opening it via its handle, racking the breaker out of the switchgear in the "disconnected" position, and padlocking it open.
2. When one of the generators needs to be repaired or taken off-line for any reason, the generator would be disconnected from the paralleling switchgear by opening a disconnect, if one was located at the generator, and repairs would commence. In the event that the paralleling switchgear is energized while the generator is being repaired (and this would happen if normal power was lost at that time and the remaining generators started and powered the switchgear), the "line side" stabs of the

disconnect located at the generator would become energized by the paralleling switchgear attempting to backfeed the generator. This possibility is eliminated by the breaker located in the paralleling switchgear; the entire feeder cable from the switchgear to the generator would be taken off-line by opening the breaker. By racking this breaker out to the "disconnected" position the possibility of the feeder cable becoming energized is totally eliminated.

3. NEC Article 445.18 requires disconnecting means for the generator. It does not require an additional disconnect at the paralleling switchgear for the same generator. In fact, if a disconnect was installed at the generator we would not have provided an additional breaker at the paralleling switchgear. This would have met the "letter" of the code but in our opinion would not have provided the same level of safety as that afforded by our design.

Please feel free to contact our office for additional information, clarifications, or other items that may be needed towards successful resolution of the referenced subject.

Very truly yours,

ALBERT KAHN ASSOCIATES, INC.
PLANNING, DESIGN AND MANAGEMENT

Athanasios Papademos, PE
Director of Electrical Engineering

c: Foote Hospital - H. Baker, J. Tatum
AKA - S. Whitney, M. Strother, C. Robinson

EXHIBIT B

Violation Notice Issued to Cochran Electric

Frank Donovan

To: Robin Steffen (E-mail)
Subject: Foote Hospital Generator Violation Notice

Robin:

Here is a correction notice for the disconnecting means required for the generator installation at Foote Hospital. We still need to conduct a final inspection of the distribution equipment feeders. Please contact me to set up an appointment.

Sincerely,

Frank Donovan, Electrical Inspector
City of Jackson
161 W. Michigan Avenue
Jackson, MI 49201
517.768.6413

Cochran-generator violation no...

Department of Community Development

161 W. Michigan Avenue • Jackson, MI 49201-1303•
Facsimile (517) 768-5832

Administrative Services
(517) 788-4060

Building Inspection
(517) 788-4012

Rehabilitation Services & Information
(517) 788-4070

March 13, 2007

Cochran Electric
2103 S. Jackson St.
Jackson, MI 49203

RE: Correction Notice-Permit PE060342

Cochran Electric:

Please make the following corrections for the generator installation at Foote Hospital;

Article 445.18 Generators shall be equipped with a disconnect by means of which the generator and all protective devices and control apparatus are able to be disconnected entirely from the circuits supplied by the generator except where:

(1) The driving means for the generator can be readily shut down; and
(2) The generator is not arranged to operate in parallel with another generator or other source of voltage.

I have been in contact with Scott Currens of Christman Construction and Peter Wroblewski of Albert Kahn Associates, Inc regarding the generator disconnecting means for Foote Hospital. I was under the impression that they were exploring their options and I have been waiting to hear what their intentions are. I understand they want to pursue an appeal to the requirement for the disconnecting means required by Article 445.18.

Sincerely,

Frank Donovan
Electrical Inspector
City of Jackson

EXHIBIT C

National Electric Code Article 445.18

higher horsepower rating of Tables 430.147 and 430.150 shall be used whenever the generator selection is between two ratings.

445.18 Disconnecting Means Required for Generators.

Generators shall be equipped with a disconnect by means of which the generator and all protective devices and control apparatus are able to be disconnected entirely from the circuits supplied by the generator except where:

(1) The driving means for the generator can be readily shut down; and

(2) The generator is not arranged to operate in parallel with another generator or other source of voltage.

Added for the 1999 *Code*, 445.18 requires that generators be equipped with a disconnect switch or circuit breaker unless the prime mover can be readily shut down and the generator is not operating in parallel with another generator or source of power.

ARTICLE 450
Transformers and Transformer Vaults (Including Secondary Ties)

Contents

450.1 Scope.

This article covers the installation of all transformers.

Exception No. 1: Current transformers.

See 110.23 for the requirement on energized current transformers that are not in use.

EXHIBIT D

National Electric Code Article 100
Definition of a Disconnecting Means

Conductor, Covered. A conductor encased within material of composition or thickness that is not recognized by this *Code* as electrical insulation.

Typical covered conductors are the green-covered equipment grounding conductors contained within a nonmetallic-sheathed cable or the uninsulated grounded system conductors within the overall exterior jacket of a Type SE cable. Covered conductors should always be treated as bare conductors for working clearances, since they are really uninsulated conductors.

Conductor, Insulated. A conductor encased within material of composition and thickness that is recognized by this *Code* as electrical insulation.

For the covering on a conductor to be considered insulation, the conductor with the covering material generally is required to pass minimum testing required by a product standard. One such product standard is UL 83, *Thermoplastic-Insulated Wires and Cables*. To meet the requirements of UL 83, specimens of finished single-conductor wires must pass specified tests that measure (1) resistance to flame propagation, (2) dielectric strength, even while immersed, and (3) resistance to abrasion, cracking, crushing, and impact. Only wires and cables that meet the minimum fire, electrical, and physical properties required by the applicable standards are permitted to be marked with the letter designations found in Tables 310.13 and 310.61. See 310.13 for the exact requirements of insulated conductor construction and applications.

Conduit Body. A separate portion of a conduit or tubing system that provides access through a removable cover(s) to the interior of the system at a junction of two or more sections of the system or at a terminal point of the system.

Boxes such as FS and FD or larger cast or sheet metal boxes are not classified as conduit bodies.

Conduit bodies are a portion of a raceway system with removable covers to allow access to the interior of the system. They include the short-radius type as well as capped elbows and service-entrance elbows.

Some conduit bodies are referred to in the trade as "condulets" and include the LB, LL, LR, C, T, and X designs. (See 300.15 and Article 314 for rules on the usage of conduit bodies.)

Types FS and FD boxes are not classified as conduit bodies; they are listed with boxes in Table 314.16(A).

Connector, Pressure (Solderless). A device that establishes a connection between two or more conductors or between one or more conductors and a terminal by means of mechanical pressure and without the use of solder.

Continuous Load. A load where the maximum current is expected to continue for 3 hours or more.

Controller. A device or group of devices that serves to govern, in some predetermined manner, the electric power delivered to the apparatus to which it is connected.

A controller may be a remote-controlled magnetic contactor, switch, circuit breaker, or device that is normally used to start and stop motors and other apparatus and, in the case of motors, is required to be capable of interrupting the stalled-rotor current of the motor. Stop-and-start stations and similar control circuit components that do not open the power conductors to the motor are not considered controllers.

Cooking Unit, Counter-Mounted. A cooking appliance designed for mounting in or on a counter and consisting of one or more heating elements, internal wiring, and built-in or mountable controls.

Copper-Clad Aluminum Conductors. Conductors drawn from a copper-clad aluminum rod with the copper metallurgically bonded to an aluminum core. The copper forms a minimum of 10 percent of the cross-sectional area of a solid conductor or each strand of a stranded conductor.

Cutout Box. An enclosure designed for surface mounting that has swinging doors or covers secured directly to and telescoping with the walls of the box proper.

Dead Front. Without live parts exposed to a person on the operating side of the equipment.

Demand Factor. The ratio of the maximum demand of a system, or part of a system, to the total connected load of a system or the part of the system under consideration.

Device. A unit of an electrical system that is intended to carry but not utilize electric energy.

Components (such as switches, circuit breakers, fuseholders, receptacles, attachment plugs, and lampholders) that distribute or control but do not consume electricity are considered devices.

Disconnecting Means. A device, or group of devices, or other means by which the conductors of a circuit can be disconnected from their source of supply.

For disconnecting means for service equipment, see Part VI of Article 230; for fuses, see Part IV of Article 240; for

EXHIBIT E

E-mail from Mr. Wroblewski

Frank Donovan

From: Wroblewski, Peter [Peter.Wroblewski@akahn.com]
Sent: Thursday, November 02, 2006 2:02 PM
To: Ben Ratliff
Cc: harold.baker@wafoote.org; Strother, Michael; Karl Grundemann
Subject: RE: Foote Hospital Generators

Ben,

Frank's statement below is absolutely correct as he has written it. However, we do have a disconnecting means which meets the intent of the code. The disconnecting means is located in the Emergency Switchgear, which is located in the same room, and is within sight of the generators. The difference is in the interpretation of the letter of the code. So we have three options:

1. We can go to the State and have them determine whether we meet the intent of the code or not. Risk - They can agree with Frank and we have to do one of the other options.
2. We can add a main circuit breaker to the two new generators. Risk - Circuit breakers will not coordinate, but trips could be set high enough to only rely on the Emergency Switchgear circuit breakers.
3. We can add a disconnect switch to the side of the two new generators. Risk - Frank still does not understand the protection scheme and could make us do option 2 also.

I don't have a good sense for the cost of any of the options, so I can't necessarily recommend one option over another. If you just look at risk level, Option 2 would eliminate the issue.

- I am ok with the Protection Scheme. I am not convinced we meet the Disconnect requirement or intent

Pete Wroblewski
Associate
Commercial/Institutional
Electrical Engineer

Albert Kahn Associates, Inc.
7430 Second Avenue
Detroit, Michigan 48202-2798
Direct Line: 313-202-7869
Direct Fax: 313-202-7369
E-mail: peter.wroblewski@akahn.com
Website: http://www.albertkahn.com

-----Original Message-----
From: Ben Ratliff [mailto:ben.ratliff@christmanco.com]
Sent: Thursday, November 02, 2006 8:20 AM
To: Wroblewski, Peter
Subject: FW: Foote Hospital Generators

Pete,
What does this mean? What do we need to do to get this resolved?

Ben

-----Original Message-----
From: Frank Donovan [mailto:fdonovan@cityofjackson.org]
Sent: Wednesday, November 01, 2006 4:54 PM
To: Peter Wroblewski (E-mail)
Cc: Ben Ratliff

Attachment 3

Subject: Foote Hospital Generators

Gentlemen,

I have been in contact with Underwriters Laboratory and The National Fire Protection Agency regarding the disconnecting means required for the new 1500 KVA generators. Both UL and NFPA agree that the generators must be equipped with a disconnecting means and that the EPO does not meet the intention of article 445.18.

I will not be able to approve this installation until it complies with article 445.18 and a disconnecting means is installed at each generator.

Respectfully,

Frank Donovan, Electrical Inspector
City of Jackson
161 W. Michigan Avenue
Jackson, MI 49201
517.768.6413

EXHIBIT F

National Electric Code Article 445.13

the series fields in parallel so as to maintain equal output voltage for each generator. The current could divide at the positive terminal, some flowing through the series field and positive lead and some flowing through the equalizer lead. The entire current generated flows through the negative lead; therefore, the fuse or circuit breaker (or at least the operating coil of the circuit breaker) must be placed in the negative lead. Overcurrent devices must be connected so as to be actuated by the entire armature output current.

An overcurrent device should not be placed in the shunt field circuit because, if the circuit were to open when the field was at full strength, an extremely high voltage would be induced that could damage the field winding insulation and the generator.

Section 445.12(C) indicates that generators operating at 65 volts or less are to be thought of as protected by the overcurrent devices that also protect the drive motor, provided these devices operate when the generator delivers 150 percent of its full-load rated current.

Exhibit 445.2 illustrates a two-pole circuit breaker with one pole connected in each lead of the main generator and with the operating coil properly designed to be connected in the neutral lead from the balancer, and arranged so as to be operated by either of the A coils or by the B coil. Each of the two generators used as a balancer set carries approximately half the unbalanced load and, thus, is always smaller than the main generator. During an excessive imbalance of the load, the balancer set would be overloaded, with no overload on the main generator; hence, a double-pole circuit breaker is connected (as noted) to guard against this condition.

Note that the authority having jurisdiction may judge that having the generator operate to failure is preferable to providing automatic means to shut it down, which, in many cases, could present a greater hazard to personnel. An overload sensing device(s) would be permitted to be connected to an annunciator or an alarm (instead of interrupting the generator) and allow operating personnel to shut down load-side equipment in a safe and orderly fashion.

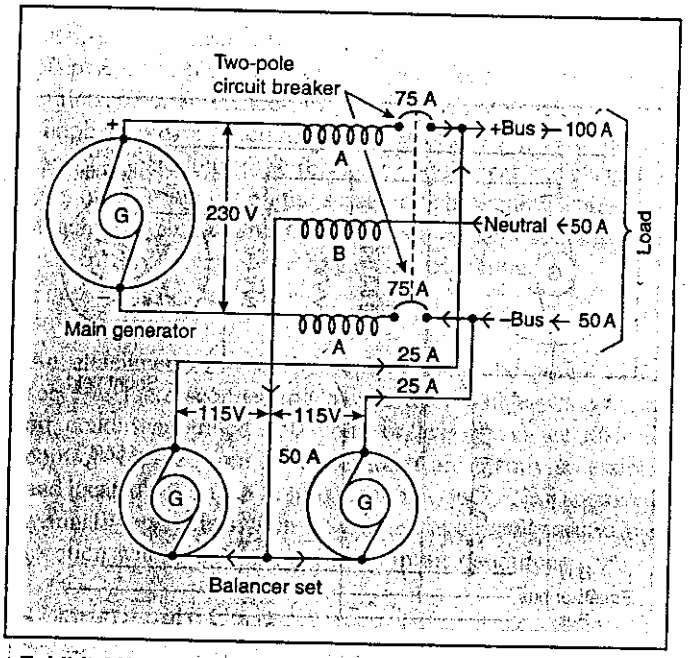


Exhibit 445.2 A two-pole circuit breaker (one pole connected in each lead of the main generator) with the opening coil connected in the neutral of the balancer set.

445.13 Ampacity of Conductors.

The ampacity of the conductors from the generator terminals to the first distribution device(s) containing overcurrent protection shall not be less than 115 percent of the nameplate current rating of the generator. It shall be permitted to size the neutral conductors in accordance with 220.22. Conductors that must carry ground-fault currents shall not be smaller than required by 250.24(B). Neutral conductors of dc generators that must carry ground-fault currents shall not be smaller than the minimum required size of the largest conductor.

Exception: Where the design and operation of the generator prevent overloading, the ampacity of the conductors shall not be less than 100 percent of the nameplate current rating of the generator.

445.14 Protection of Live Parts.

Live parts of generators operated at more than 50 volts to ground shall not be exposed to accidental contact where accessible to unqualified persons.

445.15 Guards for Attendants.

Where necessary for the safety of attendants, the requirements of 430.133 shall apply.

445.16 Bushings.

Where wires pass through an opening in an enclosure, conduit box, or barrier, a bushing shall be used to protect the conductors from the edges of an opening having sharp edges. The bushing shall have smooth, well-rounded surfaces where it may be in contact with the conductors. If used where oils, grease, or other contaminants may be present, the bushing shall be made of a material not deleteriously affected.

445.17 Generator Terminal Housings.

Generator terminal housings shall comply with 430.12. Where a horsepower rating is required to determine the required minimum size of the generator terminal housing, the full-load current of the generator shall be compared with comparable motors in Tables 430.147 through 430.150. The

Sequence of Operations

Utility Failure:

1. Automatic transfer switch(es) and/or protective relaying senses utility failure.
2. A run request is sent to the generator plant.
3. All available generators are started.
4. The first generator up to voltage and frequency is closed to the emergency bus.
5. Unsheddable loads and Load Shed Priority 1 loads are powered in under 10 seconds by the first generator on line.
6. The remaining generators are synchronized and paralleled to the emergency bus as they come up to voltage and frequency.
7. As additional generators are paralleled to the emergency bus, additional Load Shed Priority levels are added, powering their associated loads.
8. The system is now in Emergency Mode.

Utility Restoration and Exit from Emergency Mode:

1. Automatic transfer switch(es) and/or protective relaying senses that the utility source is within acceptable operational tolerances.
2. As each automatic transfer switch transfers back to utility power, it removes its run request from the generator plant.
3. When the last automatic transfer switch has retransferred to the utility and all run requests have been removed from the generator plant, all generator main circuit breakers are opened.
4. The generators are allowed to run for their programmed cooldown period.
5. The system is now back in Automatic/Standby (Utility) Mode.

Any Trip or Shutdown Event (over-voltage, under-voltage, overfrequency, emergency stop, , Reverse Power, Loss of Field, etc.):

1. Any trip or shutdown function whether it is from the circuit breaker (CB) trip unit, derived in PowerLynx, or from the Emergency Control Panel (EMCP) will result in an open command being sent to the Generator Circuit Breaker at the switchgear and the removal of the run request from the generator.
2. Once the fault/faults are cleared, the Engine Control Switch must be manually placed in the "Off/Reset" position then returned to the "Auto" position in order to start the generator again.

Fault conditions	Action	Reset
50/51 functions integral to the CB trip unit	Open command sent to generator CB Engine run command turned off	Reset by Open push button on CB
PowerLynx protectives 27/59. 81OU, 32, 40		Reset by touchscreen ECS to OFF
Engine Protectives from EMCP		Reset from EMCP

EXHIBIT 11

Section:	**Department of Plant Engineering**
Policy Name:	**Use of Lockout / Tagout Station**
Number:	**45.203**
Date:	**12/93 Revised 06/01, Reviewed 01/05**

Purpose

Anytime work is to be performed on a system in which a potential exist for injury; whether the source is electrical, mechanical, steam, hydraulic, etc; lockouts and tags are to be used.

Procedure

STEP	ACTION
1	Select any set of locks available, (any color), sign out the locks, lockout, and key using the history form located at the lockout station.
2	Use the lockout tags, which are available at the lockout station to identify yourself as working on the system. The only person to have a key to the set of locks you have signed out is you. There should be one lock on each lockout for each person working on the system. For example: if an HVAC employee is repairing a ventilator, and an electrician is troubleshooting the same system, two (2) locks of different colors should be on the lockout, one color signed out to each person.
3	If there is a shift change with the next shift continuing the repair; the history form must be filled out to indicate to whom the key was transferred.
4	In an emergency, where a particular piece of equipment must be put back into service, and the individual with the key is not available, a Supervisor may request the lock be removed. Only after a thorough check has been completed will the Supervisor remove a lock and lockout.
5	Under no circumstances will an employee remove a lock or lockout unless: - The lock and lockout are signed out to the employee. - The key has been transferred to the employee. - The Manager On-call has given approval for removal and assumes responsibility for it.
6	Loss of a key should be reported promptly so that the corresponding locks can be re-keyed.

Approvals:

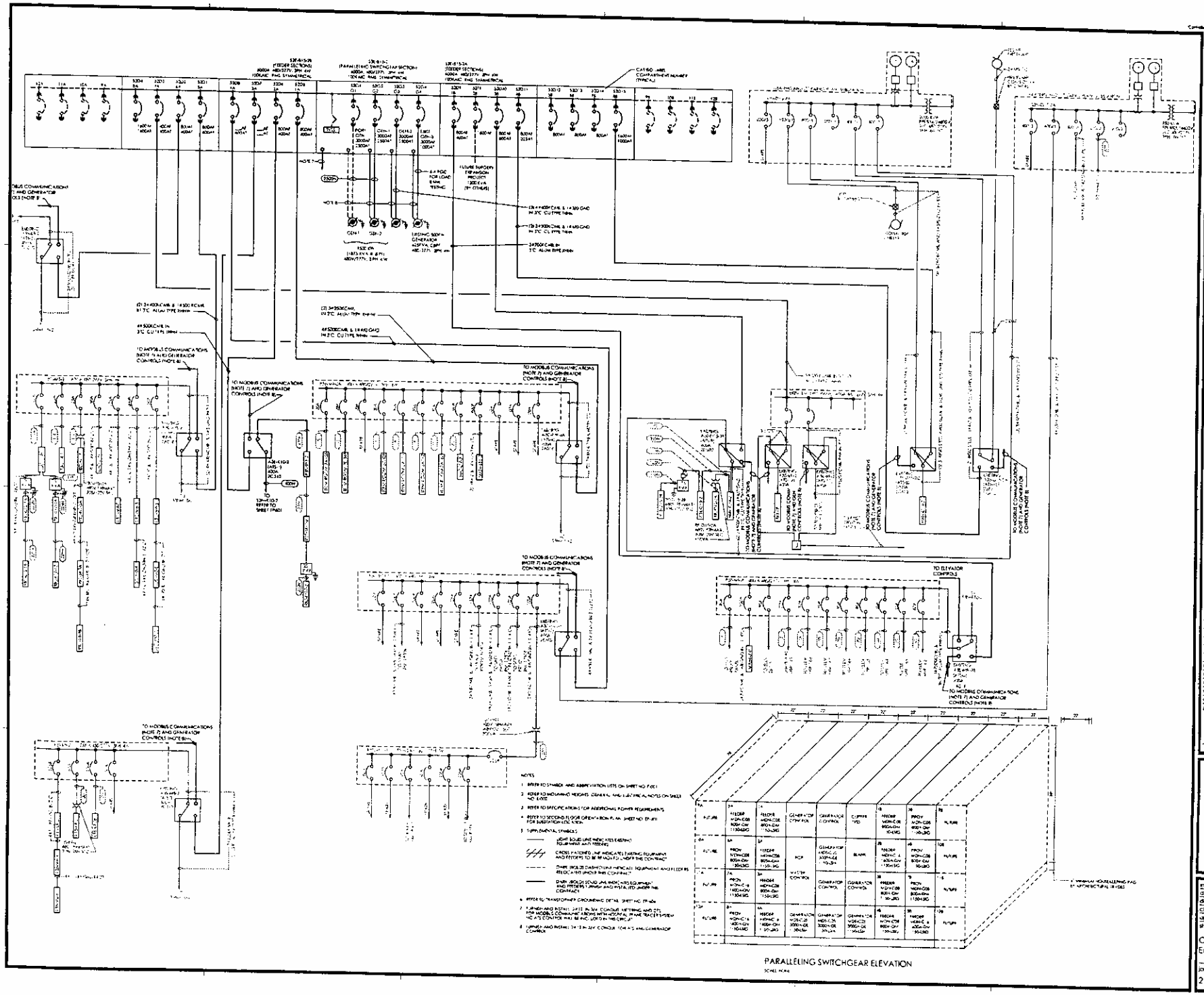
George J. Gancsos, Jr., Director of Plant Engineering

Author(s):

George Gancsos, Director, Plant Engineering

DEPARTMENT OF PLANT ENGINEERING
LOCKOUT / TAGOUT HISTORY RECORD

DATE / TIME	LOCK COLOR	# OF LOCKS USED	EMPLOYEE REPORT #	KEY TRANSFERRED TO~(EMPL.REPRT #)	# OF LOCKS RETURNED	PIECE OF EQUIPMENT LOCKED OUT & LOCATION



ALBERT KAHN ASSOCIATES, INC.

DEM	ISSUE 17	03-01-06
DEM	ISSUE 16	02-09-06
DEM	OWNER'S REVIEW	01-30-06
DEM	DEA PROGRESS PRINT	12-21-05
DEM	PROGRESS PRINT	10-28-05
dwg	issued for	date

Foote Health System

W.A. FOOTE HOSPITAL EMERGENCY DEPARTMENT EXPANSION AND RENOVATIONS

JACKSON, MICHIGAN

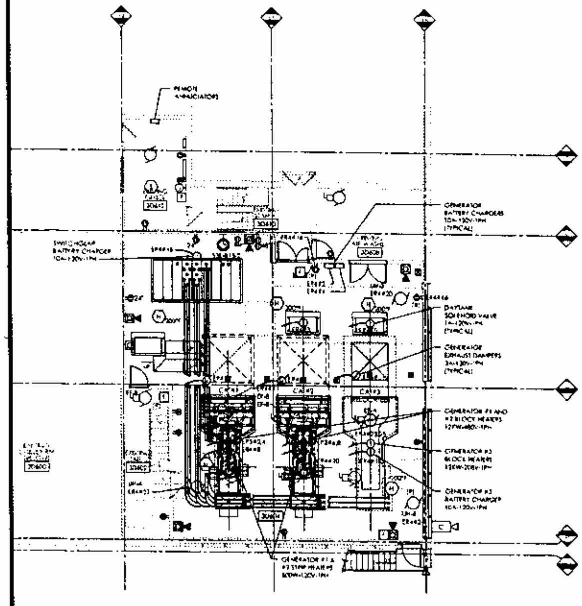
in charge
designed
drawn
checked
approved date 03-09-2006

sheet title

ONE LINE DIAGRAM - EMERGENCY

job number 2766F

sheet number EP600



MEZZANINE FLOOR PLAN - POWER AND COMMUNICATIONS

POWER NOTES:

1. REFER TO SYMBOL AND ABBREVIATION LISTS ON SHEET NO. E-001
2. REFER TO MOUNTING HEIGHTS, GENERAL AND ELECTRICAL NOTES ON SHEET NO. E-002
3. REFER TO SPECIFICATIONS FOR ADDITIONAL POWER REQUIREMENTS
4. REFER TO PANEL LOCATIONS ON SHEET NO. EP-501. REFER TO ONE-LINE DIAGRAM ON SHEET NO. EP601. REFER TO PANEL SCHEDULES ON SHEET NOS. EP602 AND EP603
5. POWER DEVICES SHOWN DARK (BOLD) WITH SOLID LINES ARE UNDER THE CONTRACT. EXISTING POWER DEVICES ARE SHOWN LIGHT WITH SOLID LINES AND SHOWN FOR REFERENCE ONLY. EXISTING LAYOUT MAY DIFFER FROM LAYOUT SHOWN ON THIS DRAWING
6. PREFIXES ON CIRCUITING DESIGNATES THE FOLLOWING UNLESS NOTED OTHERWISE

P1 - PREFIX INDICATES CIRCUITING TO P3H-MB-1
P2 - PREFIX INDICATES CIRCUITING TO P3H-L13-1
P3 - PREFIX INDICATES CIRCUITING TO P3H-M17-2
L1 - PREFIX INDICATES CIRCUITING TO L3H-L18-1
L2 - PREFIX INDICATES CIRCUITING TO L3H-L1-1
L3 - PREFIX INDICATES CIRCUITING TO L3H-U16-2
R1 - PREFIX INDICATES CIRCUITING TO R1-HL13-1
R2 - PREFIX INDICATES CIRCUITING TO R1-HM18-1
R3 - PREFIX INDICATES CIRCUITING TO R1-HM17-2
R4 - PREFIX INDICATES CIRCUITING TO R1-HU16-2
R5 - PREFIX INDICATES CIRCUITING TO R1-HL11-1
R6 - PREFIX INDICATES CIRCUITING TO R1-HM18-C

CP1 - PREFIX INDICATES CIRCUITING TO P3C-MB-2
CL1 - PREFIX INDICATES CIRCUITING TO L3C-L13-1
CL2 - PREFIX INDICATES CIRCUITING TO L3C-L11-1
CR1 - PREFIX INDICATES CIRCUITING TO R1C-L13-1
CR2 - PREFIX INDICATES CIRCUITING TO R1C-M18-1
CR3 - PREFIX INDICATES CIRCUITING TO R1C-L11-1

LP1 - PREFIX INDICATES CIRCUITING TO P3S-49-2
LL1 - PREFIX INDICATES CIRCUITING TO L3S-49-2A
LL2 - PREFIX INDICATES CIRCUITING TO L3S-49-2B
LR1 - PREFIX INDICATES CIRCUITING TO R1S-49-2

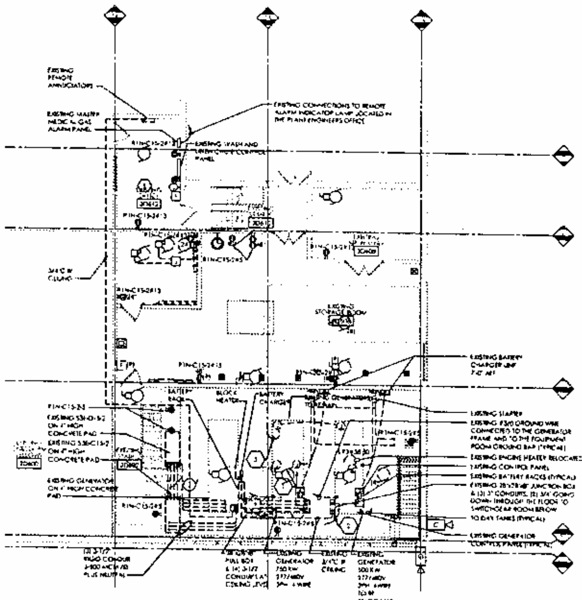
EP1 - PREFIX INDICATES CIRCUITING TO P3E-L11-2
EP2 - PREFIX INDICATES CIRCUITING TO P3E-M17-2
EP3 - PREFIX INDICATES CIRCUITING TO P3E-D15-2
ER1 - PREFIX INDICATES CIRCUITING TO R1E-M17-2
ER2 - PREFIX INDICATES CIRCUITING TO R1E-[illegible]
ER3 - PREFIX INDICATES CIRCUITING TO R1E-D15-2A
ER4 - PREFIX INDICATES CIRCUITING TO R1E-D15-2B

LETTERS AND NUMBERS IN PARENTHESIS, LOCATED NEXT TO ELECTRICAL DEVICES, FOLLOWING ROOM NAMES AND NUMBERS, REPRESENT PANEL DESIGNATIONS AND CORRESPONDING CIRCUIT NUMBERS. CIRCUIT NUMBERS INDICATED FOR EXISTING PANELS ARE SCHEMATIC ONLY. FIELD VERIFY EXACT CIRCUIT NUMBERS

8. REFER TO MECHANICAL/ELECTRICAL SCHEDULES FOR MECHANICAL EQUIPMENT REQUIREMENTS ON SHEET NOS. ME-701 AND ME-002
9. REFER TO ARCHITECTURAL INTERIOR ELEVATIONS FOR COORDINATION OF ELECTRICAL DEVICES
9. FURNISH AND INSTALL WEATHERPROOF GFI RECEPTACLES ON ROOF WITHIN 25 FEET OF MECHANICAL EQUIPMENT. REFER TO ROOF PLAN ON SHEET NO. EP172
10. REFER TO ARCHITECTURAL INTERIOR ELEVATIONS AND REFLECTED CEILING PLANS FOR COORDINATION OF ELECTRICAL DEVICES
11. FIELD VERIFY EXISTING CONDITIONS TO ENSURE SPACE ABOVE CEILING FOR RECESSED LIGHTING FIXTURES. COORDINATE ANY CONFLICTS WITH ARCHITECT/ENGINEER REPRESENTATIVE
12. FIELD VERIFY EXISTING CONDITIONS TO ENSURE FEEDING CORRECT PUMPS WITH CORRECT CIRCUITS. LABEL DISCONNECT SWITCHES PER SPECIFICATION REQUIREMENTS. REFER TO SHEET EP601
13. RELOCATE EXISTING 480V/3PH COMBINATION STARTER AND DISCONNECT SWITCHES AS SHOWN. COORDINATE LOCATION WITH MECHANICAL TRADE AND SHEETS

COMMUNICATION NOTES:

1. REFER TO SYMBOL AND ABBREVIATION LISTS ON SHEET NO. E-001
2. REFER TO MOUNTING HEIGHTS, GENERAL AND ELECTRICAL NOTES ON SHEET NO. E-002
3. REFER TO SPECIFICATIONS FOR ADDITIONAL COMMUNICATION REQUIREMENTS
4. REFER TO ARCHITECTURAL INTERIOR ELEVATIONS AND REFLECTED CEILING PLANS FOR COORDINATION OF ELECTRICAL DEVICES
5. COMMUNICATION DEVICES SHOWN DARK (BOLD) WITH SOLID LINES ARE UNDER THIS CONTRACT. EXISTING COMMUNICATION DEVICES ARE SHOWN LIGHT WITH SOLID LINES AND SHOWN FOR REFERENCE ONLY. EXISTING LAYOUT MAY DIFFER FROM LAYOUT SHOWN ON THIS DRAWING
6. EXTEND EXISTING FIRE ALARM SYSTEM CIRCUITING TO ACCOMMODATE DEVICES INSTALLED UNDER THIS CONTRACT AS REQUIRED. REPROGRAM FIRE ALARM CONTROL PANEL AS REQUIRED. REFER TO COMMUNICATION NOTE 3
7. EXTEND EXISTING PAGING SYSTEM CIRCUITING TO ACCOMMODATE DEVICES INSTALLED UNDER THIS CONTRACT AS REQUIRED. REFER TO COMMUNICATION NOTE 3
8. EXTEND EXISTING TELEPHONE/DATA CIRCUITS AS REQUIRED. REFER TO COMMUNICATION NOTE 3
9. EXTEND EXISTING NURSE CALL SYSTEM CIRCUITING TO ACCOMMODATE DEVICES INSTALLED UNDER THIS CONTRACT AS REQUIRED. REFER TO COMMUNICATION NOTE 3
10. OWNER FURNISHED AND CONTRACTOR INSTALLED CAMERA. TERMINATE WIRES AND CONDUIT INTO MONITOR JACK AT CONTROL CONSOLE IN ROOM 162



MEZZANINE FLOOR - DEMOLITION

EXISTING ELECTRICAL NOTES:

(1) [illegible] AND CONNECTIONS FOR THE GENERATOR ENGINE IMMERSION HEATERS
(2) TO REMOVE ALARM BELL AND TROUBLE LIGHTS LOCATED IN THE ENGINEERS OFFICE AND SWITCHBOARD ROOM
(3) 120V POWER SUPPLY FOR [illegible] THAT SUPPORT THE GENERATOR EXCHANGE DAMPERS, CHARGERS, DAY TANKS

DEMOLITION NOTES:

1. REFER TO SYMBOL AND ABBREVIATION LISTS ON SHEET NO. E-001
2. REFER TO MOUNTING HEIGHTS, GENERAL AND ELECTRICAL NOTES ON SHEET NO. E-002
3. REFER TO SPECIFICATIONS FOR ADDITIONAL DEMOLITION REQUIREMENTS.
4. LIGHTING FIXTURES, PANELS, AND OTHER EQUIPMENT LOCATED WITHIN DEMOLITION AREAS SHALL BE REMOVED AS INDICATED BY ELECTRICAL DEVICES SHOWN DARK (BOLD) AND DASHED ON FLOOR PLANS. COORDINATE REUSABLE FIXTURES WITH OWNER'S AND ARCHITECT-ENGINEER REPRESENTATIVE. EXISTING ITEMS ARE SHOWN LIGHT SOLID AND SHOWN FOR REFERENCE ONLY. EXISTING LAYOUT MAY DIFFER FROM LAYOUT SHOWN ON THIS DRAWING
4. PREFIXES ON CIRCUITING DESIGNATES THE FOLLOWING UNLESS NOTED OTHERWISE

P1 - PREFIX INDICATES CIRCUITING TO P3H-MB-2
P2 - PREFIX INDICATES CIRCUITING TO P3H-L13-1
P3 - PREFIX INDICATES CIRCUITING TO P3H-M17-2
L1 - PREFIX INDICATES CIRCUITING TO L3H-L13-1
L2 - PREFIX INDICATES CIRCUITING TO L3H-L11-1
L3 - PREFIX INDICATES CIRCUITING TO L3H-U16-2
R1 - PREFIX INDICATES CIRCUITING TO R1-HL13-1
R2 - PREFIX INDICATES CIRCUITING TO R1-HM18-1
R3 - PREFIX INDICATES CIRCUITING TO R1-HM17-2
R4 - PREFIX INDICATES CIRCUITING TO R1-HU16-2
R5 - PREFIX INDICATES CIRCUITING TO R1-HL11-1
R6 - PREFIX INDICATES CIRCUITING TO R1-HM18-C

CP1 - PREFIX INDICATES CIRCUITING TO P3C-MB-2
CL1 - PREFIX INDICATES CIRCUITING TO L3C-L13-1
CL2 - PREFIX INDICATES CIRCUITING TO L3C-L11-1
CR1 - PREFIX INDICATES CIRCUITING TO R1C-L13-1
CR2 - PREFIX INDICATES CIRCUITING TO R1C-M18-1
CR3 - PREFIX INDICATES CIRCUITING TO R1C-L11-1

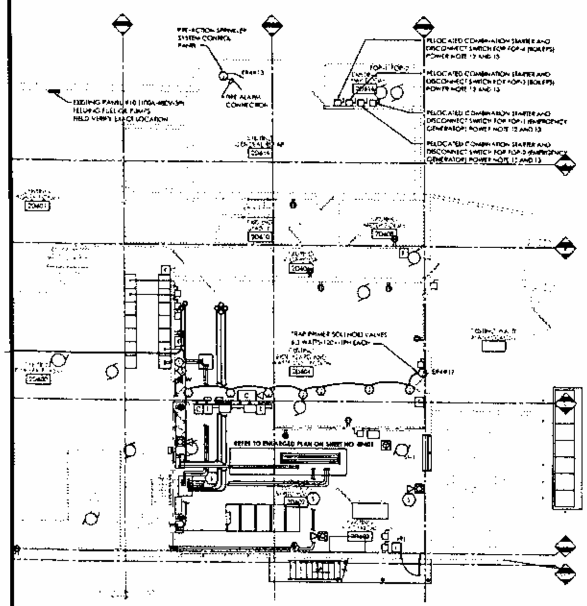
LP1 - PREFIX INDICATES CIRCUITING TO P3S-49-2
LL1 - PREFIX INDICATES CIRCUITING TO L3S-49-2A
LL2 - PREFIX INDICATES CIRCUITING TO L3S-49-2B
LR1 - PREFIX INDICATES CIRCUITING TO R1S-49-2

EP1 - PREFIX INDICATES CIRCUITING TO P3E-L11-2
EP2 - PREFIX INDICATES CIRCUITING TO P3E-M17-2
EP3 - PREFIX INDICATES CIRCUITING TO P3E-D15-2
ER1 - PREFIX INDICATES CIRCUITING TO R1E-M17-2
ER2 - PREFIX INDICATES CIRCUITING TO R1E-[illegible]
ER3 - PREFIX INDICATES CIRCUITING TO R1E-D15-2A
ER4 - PREFIX INDICATES CIRCUITING TO R1E-D15-2B

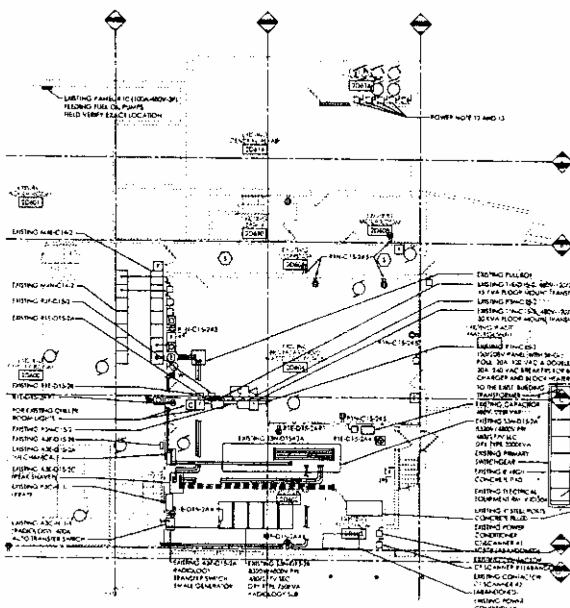
LETTERS AND NUMBERS IN PARENTHESIS, LOCATED NEXT TO ELECTRICAL DEVICES, FOLLOWING ROOM NAMES AND NUMBERS, REPRESENT PANEL DESIGNATIONS AND CORRESPONDING CIRCUIT NUMBERS. CIRCUIT NUMBERS INDICATED FOR EXISTING PANELS ARE SCHEMATIC ONLY. FIELD VERIFY EXACT CIRCUIT NUMBERS

7. ANY SPARES OR NEWLY VACATED CIRCUITS MAY BE REUSED FOR INSTALLATION OF CIRCUITS AND ADDITIONAL LOADS ADDED UNDER THIS CONTRACT
8. RECEPTACLES, SWITCHES, LIGHTS, DATA OUTLETS, AND CONTROLS SHOWN TO BE REMOVED FROM A WALL WHICH IS SCHEDULED TO REMAIN, SHALL HAVE WIRING REMOVED BACK TO RESPECTIVE PANEL OR FIRST ACTIVE JUNCTION BOX TO REMAIN. FURNISH AND INSTALL A BLANK COVERPLATE AS NEEDED
9. CARE SHALL BE TAKEN WHEN WORKING ON CIRCUITS WHICH EXTEND BEYOND BOUNDARIES OF WORK AREA. POWER TO FIXTURES AND EQUIPMENT OUTSIDE AREA OF DEMOLITION SHALL NOT BE TURNED OFF WITHOUT PRIOR PERMISSION FROM OWNER'S REPRESENTATIVE
10. WHERE ITEM TO BE REMOVED IS CIRCUITED BETWEEN TWO ITEMS TO REMAIN, REMOVE ONLY WIRE AND CONDUIT NECESSARY TO REMOVE ITEM. RE-ESTABLISH CIRCUIT BETWEEN ITEMS TO REMAIN
11. CONSULT ARCHITECTURAL DRAWINGS FOR FULL EXTENT OF DEMOLITION WORK REQUIRED UNDER THIS CONTRACT
12. EXISTING GENERATOR TO BE RELOCATED. EXTEND ALL CIRCUITS, CONDUIT, AND WIRING TO LOCATION SHOWN ON THIS SHEET. CONDUIT AND WIRING MAY NOT BE REUSED FOR POWER AND CONTROL CIRCUITS
13. SUPPLEMENTAL SYMBOLS

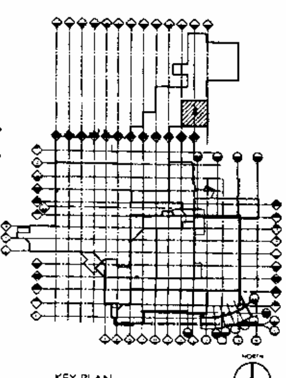
LIGHT SOLID LINE INDICATES EXISTING EQUIPMENT AND FEEDERS
CROSS HATCHED LINE INDICATES EXISTING EQUIPMENT AND FEEDERS TO BE REMOVED UNDER THIS CONTRACT
DARK (BOLD) DASHED LINE INDICATES EQUIPMENT AND FEEDERS TO BE REMOVED UNDER THIS CONTRACT
DARK (BOLD) SOLID LINE INDICATES EQUIPMENT AND FEEDERS FURNISH AND INSTALLED UNDER THIS CONTRACT



PARTIAL SECOND FLOOR PLAN - POWER AND COMMUNICATIONS



PARTIAL SECOND FLOOR PLAN - DEMOLITION



KEY PLAN

ALBERT KAHN ASSOCIATES, INC.

GML	ISSUE 17	03-21-06
GML	ISSUE 16	03-09-06
GML	OWNER REVIEW	01-20-06
GML	100% PROGRESS PRINT	12-21-05
GML	PROGRESS PRINT	10-24-05
pkg	issued for	date

Foote Health System

W.A. FOOTE HOSPITAL
EMERGENCY DEPARTMENT
EXPANSION AND
RENOVATIONS

JACKSON, MICHIGAN

in charge
designed
drawn
checked
approved — date 03-09-2006
PARTIAL SECOND AND MEZZANINE FLOOR PLANS - DEMO., POWER, AND COMM.
job number 2766F
sheet number EP123

APPLICATION FOR VARIANCE

Receipt # 00003813

Building Code Board of Appeals

RECEIVED
APR 3 - 2007

Chapter 14 - Housing Code

I/We have received the code violation letter issued by the Community Development Department for the below-referenced property and wish to file an appeal for consideration. Please place this request on the agenda for the next possible Building Code Board of Appeals meeting.

FOOTE HOSPITAL
205 N. EAST AVE
PROPERTY ADDRESS

FRANK DONOVAN
INSPECTOR NAME

COCHRAN ELECT.
OWNER/AGENT NAME

2103 S. JACKSON ST
OWNER/AGENT STREET ADDRESS

517 784 7106
TELEPHONE NUMBER

JACKSON MI 49203
CITY/STATE/ZIP CODE

SECTION OF CODE REQUESTING VARIANCE FROM: Appeal decision made by electrical inspector

PROPOSED ALTERNATIVE (Reason for appeal - attach additional sheets if necessary):

The Engineer does not feel the code needs the Disconnects for this System

A LETTER IS ATTACHED.

OWNER/AGENT SIGNATURE: Ronald E Cochran DATE: 4-3-06
Permit # PE0603 42

DO NOT WRITE BELOW THIS LINE - FOR OFFICE USE ONLY

Building Code Board of Appeals Agenda Date: 4/19/07

Owner/Agent Notified of Hearing: 4/9/07

Variance Approved: 4/19/07 Variance Denied:

Board Action: BCBA denied the Variance request.

Owner/Agent Present at Hearing: yes

Owner/Agent Notified of Board Decision: yes - 4/20/07

EXHIBIT 12

Item 9 205 N East Ave – Appeal for Variance

Report: Donovan – Cochran Electric has installed new generators for the hospital, however, the generators are not equipped with disconnects. I had concerns so I contacted the NFPA and UL to discuss the requirements of the code. After discussions with them they agreed that the generators did not meet the code requirement. Discussed 44.18 "Disconnecting Means Required for Generators" of the NEC with the board members. Also discussed with the Board what exception the code allows. What they have installed does not meet that exception. I don't want to put the City or myself out there if this was to fail with this being in a Hospital. If you look at the definition of "disconnect" and then look at the code exceptions what we have is not acceptable. The violation notice that I issued was for the "Disconnect" at the generator not for over current. I believe the design is great however, as the Code is written I cannot approve it. My problem is that the Alternate Method does not meet the Code requirements and I'm not comfortable making a decision when it comes to a Hospital/Heart Surgery Clinic. When I went to both Organizations I went with a positive attitude for Foote Hospital not with an attitude that I wanted to win this fight and both Organizations stated that what has been installed does not meet the Code. The Code reads that the generator must be able to be disconnected at the generator not in the same room at another location.

Appeal: Tom, Architect for the project – The way the system operators, if anything was to happen to the generator the EPO switch is manual however, the generator would shut down automatically. We have installed the same material in three other locations where they were all accepted. One is at an Insurance Company and two are at other Hospital locations. The disconnect would primarily be installed as a safety issue and I don't believe the way it is currently installed is a safety issue. We considered putting the disconnect on the generators but it did not seem that we should pay the extra money or take the extra time to do it when it has been used before and has never been an issue. The concern is that it is installed in a Hospital, the disconnect has nothing to do with the place of business where the generator has been installed but with the generator itself. There was no compromise to the safety of the people working within the room or in the area of the room and that is why we proceeded with the installation. We have to start here, if you feel you need more time and would like me to provide you with the information we have that is fine by us, we are not asking for you to make a decision right now. I believe if it can be resolved at your level it would be a lot less time than if we where to apply to the State. When the generator was all by itself it had to have a disconnect because the other switchgear did not exist.

Ronald Cochran, Electrical Contractor – Don't see why not having the switch on the generator but having it in another location is such an issue. All of the equipment is in the same room, the disconnect is within 35 feet of the equipment, that room is only used for generators, the breaker can be shut off, locked out and can be seen from the equipment it's self. Described to the board what the breaker/disconnect looks like as it is now. Reviewed with the Board members pictures of the equipment that is currently installed.

Item 9: **205 N East Ave (continued)**

Discussion:

Woodard – Believes this may be a better decision to be made by the State, who has the expertise. Why wouldn't the applicant just go to the state and get this method approved as an alternate method so they would never have to go through this again. We, unlike other communities, have an electrical inspector who really knows his job. There is no way I will vote on this because I'm not qualified in this area and I'm sure not going to vote against what the NFPA and UL stated. I would recommended going to the State who would be more qualified to make a decision of this nature, I think asking us to make a decision of this nature is just a waste of time.

Berkemeier – My concern is this is a Code that is not written by us but which is written by people with the expertise and I don't want to make a snap decision. When the inspector comes to us and tells us he doesn't feel comfortable accepting this, without me having any expertise in this field I would not feel comfortable making a decision. We could table this so that the staff on this board could do some more research, you could apply to the State as the Electrical Inspector has stated or you could put the disconnect switch in. I don't want to suggest that if we wait another month to accept some more information and do some more research that we would feel any different then we do right now and that we would accept this. You may want to research your other options also.

Bosell – We don't have to grant a Variance, we could accept an Alternate Method. I think we should put it back in the Building Inspection's Department hands, they can accept an Alternate Method. Will be voting no on the motion because I feel Frank could make a decision to accept.

Murphy – Questioned if other generators had been removed in order for new one's to be installed. The old generator that is still there, according to Frank's interpretation is the correct one.

Action Taken: Woodard (M), Chinavare (S) – Deny the request for variance

Vote: Berkemeier – Y, Woodard – Y, Chinavare – Y, Bosell – N, Benedetto – Abstain

Woodard stepped out 2:20 p.m.

Returned at 2:25 p.m.

JENNIFER M. GRANHOLM
GOVERNOR

MICHIGAN DEPARTMENT OF LABOR & ECONOMIC GROWTH
BUREAU OF CONSTRUCTION CODES

MASTER ELECTRICIAN LICENSE
ISSUED BY
THE ELECTRICAL ADMINISTRATIVE BOARD

EMPLOYER - COCHRAN ELECTRIC

COCHRAN, RONALD E
4710 PICKETT RD
PARMA MI 49269

LICENSE NO.	EXPIRATION DATE
6208771	12/31/2007

BCC-860 (7/06)

THIS DOCUMENT IS DULY ISSUED UNDER THE LAWS OF THE STATE OF MICHIGAN

JENNIFER M. GRANHOLM
GOVERNOR

MICHIGAN DEPARTMENT OF LABOR & ECONOMIC GROWTH
BUREAU OF CONSTRUCTION CODES

ELECTRICAL CONTRACTOR LICENSE
ISSUED BY
THE ELECTRICAL ADMINISTRATIVE BOARD

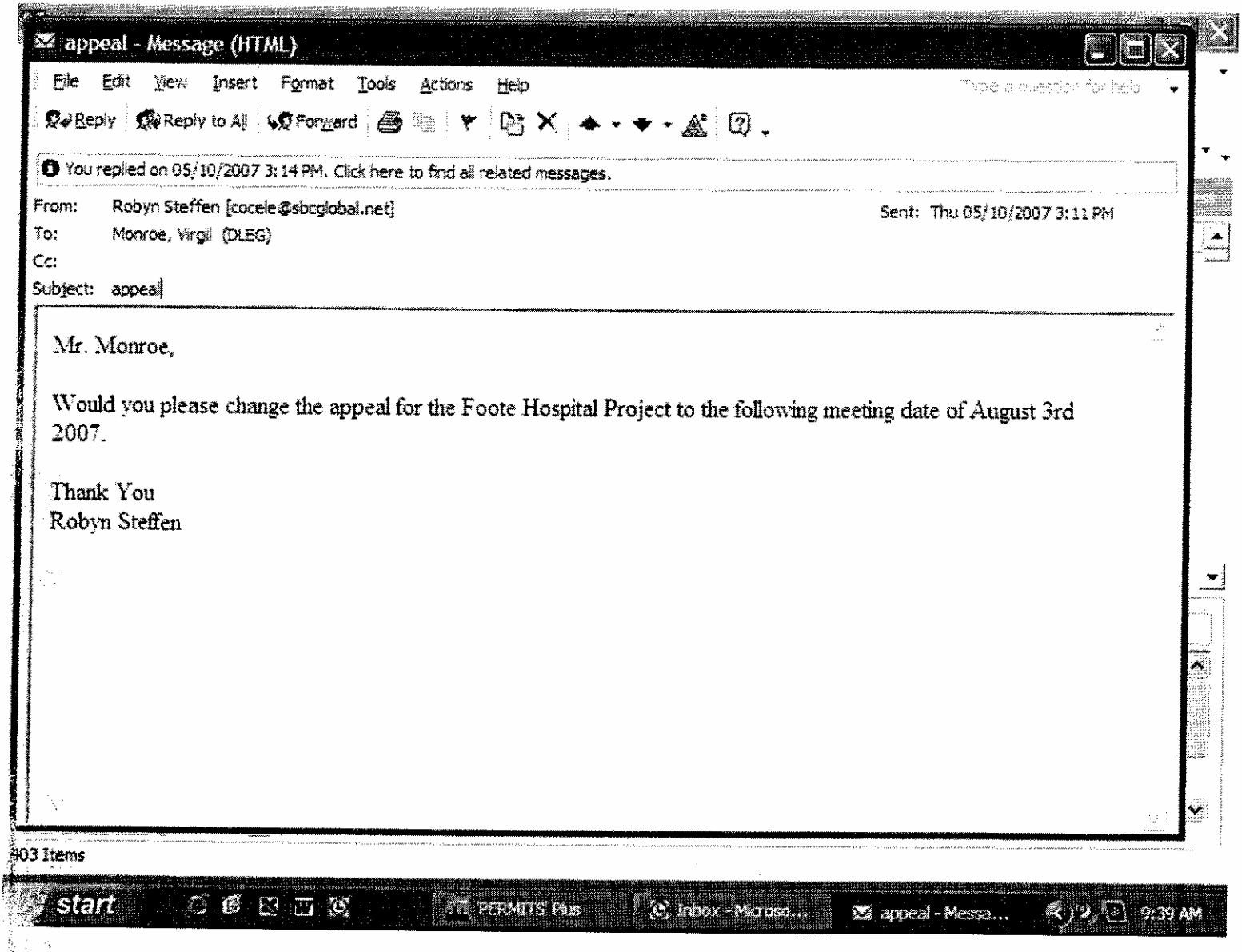
CONTRACTOR OF RECORD - RONALD E COCHRAN
MASTER - COCHRAN, RONALD E

COCHRAN ELECTRIC
2103 S JACKSON ST
JACKSON, MI 49203

LICENSE NO.	EXPIRATION DATE
6107095	12/31/2009

BCC-859 (7/06)

THIS DOCUMENT IS DULY ISSUED UNDER THE LAWS OF THE STATE OF MICHIGAN


appeal - Message (HTML)
File Edit View Insert Format Tools Actions Help
Reply Reply to All Forward
You replied on 05/10/2007 3:14 PM. Click here to find all related messages.
From: Robyn Steffen [cocele@sbcglobal.net]
Sent: Thu 05/10/2007 3:11 PM
To: Monroe, Virgil (DLEG)
Cc:
Subject: appeal
Mr. Monroe,
Would you please change the appeal for the Foote Hospital Project to the following meeting date of August 3rd 2007.
Thank You
Robyn Steffen

803 Items

start
PERMITS Plus
Inbox - Microso...
appeal - Messa...
9:39 AM

JENNIFER M. GRANHOLM
GOVERNOR

STATE OF MICHIGAN
DEPARTMENT OF LABOR & ECONOMIC GROWTH
LANSING

KEITH W. COOLEY
DIRECTOR

August 3, 2007

E-07-14

TO: Members of the State Electrical Administrative Board

FROM: Virgil Monroe, Chief, Electrical Division

SUBJECT: Program approval for Kellogg Community College.

APPLICANT REPRESENTATIVE:

Kellogg Community College / Kevin Barnes

PROJECT:

Not applicable.

AUTHORITY:

The Michigan Electrical Administrative Act of 1956 as Amended, being Act 217 of the Michigan Compiled Laws.

REQUEST:

Approval of Industrial Electricity / Electronics program.

APPLICABLE RULE:

338.883d, 338.1005a (2) (b)

FINDINGS:

Kellogg Community College is requesting approval of 781 hours for their Industrial Electricity / Electronics program to be approved towards the 8000 hour requirement for the journeyman's license examination.

RECOMMENDATION:

Staff recommends approval of the program for the 781 hours towards the required 8000 hours of experience; however the applicant must still provide documentation of a minimum of four years experience.

JENNIFER M. GRANHOLM
GOVERNOR

STATE OF MICHIGAN
DEPARTMENT OF LABOR & ECONOMIC GROWTH
LANSING

KEITH W. COOLEY
DIRECTOR

MICHIGAN STATE ELECTRICAL ADMINISTRATIVE BOARD
BUREAU OF CONSTRUCTION CODES
2501 Woodlake Circle
Okemos, Michigan 48864

Appeal Docket No.
ELEC-07-14

Petitioner, Kellogg Community College/Kevin Barnes

Vs.

Respondent, Michigan Department of Labor & Economic Growth, Bureau of Construction Codes

NOTICE OF HEARING

Date: August 3, 2007
Time: 9:30 a.m.
Location: Department of Labor & Economic Growth, Bureau of Construction Codes
2501 Woodlake Circle, Okemos, Michigan 48864

Pursuant to the authority contained in Rule 338.1005a General Administrative Board Rules.

A Hearing will be held in response to the request of Kevin Barnes/Kellogg Community College, 450 North Ave., Battle Creek, MI 49017, for approval of hours towards the 8000 hour requirement for the journey examination.

MICHIGAN STATE ELECTRICAL ADMINISTRATIVE BOARD

Virgil Monroe, Chief of Electrical Division

July 19, 2007
Date

KELLOGG COMMUNITY COLLEGE

450 North Avenue • Battle Creek, MI 49017-3397 • (269) 965-3931

May 14, 2007

Mr. Virgil Monroe
Director, Electrical Division
MDLEG
Bureau of Construction Codes
P.O. Box 30254
Lansing, MI 48909

Dear Mr. Monroe:

As per out telephone conversation, I have enclosed information on the Industrial Electricity/Electronics program at the Regional Manufacturing Technology Center to present to the Electrical Administrative Board. The Industrial Electricity/ Electronics program is a structured, associate degree program which has been approved by the State of Michigan. As a benefit to our students, I am requesting approval of the program as related trade instruction towards the 8000 hour requirement for state journeyman license.

The structure of the program is an open entry/open exit format that allows students to work at their own pace giving them the greatest amount of flexibility with work schedules. Because of the self-paced nature of the program, there is never any instruction time that is lost or missed due to the student's absence. A large share of the program includes hands-on lab work that is overseen by an instructor. This one-on-one instruction is given to assure the student understands the material. Students must achieve a passing grade of at least 90% on the module exam in order to advance.

As you will see, the basic program has 781 contact hours and twenty four contact hours are required for every credit hour of the college degree. As one of two instructors in the program, I hold a State of Michigan Masters Electrical License and am also a state approved code update provider. Our other instructor, Tim Krueger, holds a bachelors degree in electrical engineering from Western Michigan University.

If you have concerns or questions as you proceed with the approval process please feel free to contact me. I would also like to attend the board meeting on June 1 2007 in the event additional information is required by the board. It would be my pleasure to provide you with a tour of our facility if you should be in the Battle Creek area. I can also be available to bring any further materials that may be necessary to you in Lansing. Thank you for your time and consideration,

Sincerely,

Kevin Barnes
Industrial Electricity/Electronics instructor

Enc. Course outline
Lab description sheets

K E L L O G G C O M M U N I T Y C O L L E G E

TERM: 2006 FALL

(All costs are subject to change without notice. Please call 269-965-4137 to verify.)

INDUSTRIAL ELECTRICITY/ELECTRONICS PROGRAM

PACKET NUMBER	PACKET TITLE	CRED	CONT HOURS	LAB FEES	TUITION	TOTAL COST
UNIT 1	ELECTRICAL SAFETY					
INEL 1A	ELECTRICAL SAFETY	0.17	4	2.00	21.17	23.17
	UNIT TOTAL	0.17	4	2.00	21.17	23.17
UNIT 2	MATHEMATICS FOR ELECTRICIANS					
INEL 2A	MATHEMATICS I	0.08	2	2.00	9.96	11.96
INEL 2B	MATHEMATICS II	0.25	6	15.00	31.13	46.13
INEL 2C	MATHEMATICS III	0.25	6	2.00	31.13	33.13
	UNIT TOTAL	0.58	14	19.00	72.22	91.22
UNIT 3	ELECTRICAL THEORY					
INEL 3A	ELECTRICAL THEORY	0.25	6	20.00	31.13	51.13
INEL 3B	STATIC ELECTRICITY	0.25	6	20.00	31.13	51.13
INEL 3C	CALCULATORS & ELECTRONICS	0.25	6	5.00	31.13	36.13
INEL 3D	DEVICES & SYMBOLS	0.25	6	25.00	31.13	56.13
INEL 3E	MULTIMETER	0.33	8	25.00	41.09	66.09
INEL 3F	OHM'S LAW	0.33	8	5.00	41.09	46.09
INEL 3G	SERIES CIRCUITS	0.33	8	5.00	41.09	46.09
INEL 3H	PARALLEL CIRCUITS	0.33	8	5.00	41.09	46.09
INEL 3J	SERIES & PARALLEL CIRCUITS	0.33	8	5.00	41.09	46.09
INEL 3K	MAGNETISM	0.25	6	5.00	31.13	36.13
INEL 3L	ALTERNATING CURRENT	0.25	6	5.00	31.13	36.13
INEL 3M	OSCILLOSCOPE	0.33	8	5.00	41.09	46.09
INEL 3N	INDUCTANCE	0.42	10	5.00	52.29	57.29
INEL 3P	CAPACITANCE	0.42	10	5.00	52.29	57.29
INEL 3Q	R.C.L. CIRCUITS	0.33	8	5.00	41.09	46.09
INEL 3R	CONDUCTION	0.33	8	5.00	41.09	46.09
INEL 3S	THEORY OVERVIEW	0.21	5	5.00	26.15	31.15
	UNIT TOTAL	5.19	125	155.00	646.23	801.23
UNIT 4	NATIONAL ELECTRICAL CODE (NEC)					
INEL 4A	GENERAL WIRING FUNDAMENTALS	0.25	6	30.00	31.13	61.13
INEL 4B	WIRE, RACEWAY & BOX SIZING	0.33	8	30.00	41.09	71.09
INEL 4C	BRANCH CIRCUITS	0.33	8	5.00	41.09	46.09
INEL 4D	SERVICE & FEEDER CALCULATIONS	0.25	6	5.00	31.13	36.13
INEL 4E	GROUNDING & BONDING	0.33	8	5.00	41.09	46.09
INEL 4F	OVERCURRENT PROTECTION	0.33	8	5.00	41.09	46.09
INEL 4G	MOTOR CIRCUIT WIRING	0.25	6	5.00	31.13	36.13
INEL 4H	TRANSFORMERS	0.25	6	10.00	31.13	41.13
INEL 4J	GENERAL HAZARDOUS LOCATIONS	0.25	6	5.00	31.13	36.13
INEL 4K	HEALTH CARE FACILITIES	0.25	6	5.00	31.13	36.13
INEL 4L	EMERGENCY POWER SYSTEMS	0.33	8	5.00	41.09	46.09
INEL 4M	INDUSTRIAL APPLICATIONS	0.33	8	10.00	41.09	51.09
INEL 4N	SPECIAL APPLICATION WIRING	0.25	6	5.00	31.13	36.13
INEL 4P	NEC REVIEW	0.17	4	5.00	21.17	26.17
	UNIT TOTAL	3.90	94	130.00	485.62	615.62

TERM: 2006 FALL

(All costs are subject to change without notice. Please call 269-965-4137 to verify.)

INDUSTRIAL ELECTRICITY/ELECTRONICS PROGRAM

PACKET NUMBER	PACKET TITLE	CRED	CONT HOURS	LAB FEES	TUITION	TOTAL COST
UNIT 5	ELECTRICAL MOTOR CONTROLS 1					
WBEL 5A	ELECTRICAL MOTOR CONTROLS	0.42	10	10.00	52.29	62.29
WBEL 5B	MANUAL MOTOR CONTROL	0.50	12	10.00	62.25	72.25
WBEL 5C	CONTROL TRANSFORMERS	0.42	10	10.00	52.29	62.29
WBEL 5D	CONTROL LADDER LOGIC	0.67	16	10.00	83.42	93.42
WBEL 5E	CONTROL RELAYS & MOTOR STARTER	0.50	12	10.00	62.25	72.25
WBEL 5F	INTRO TO TROUBLESHOOTING	0.33	8	10.00	41.09	51.09
WBEL 5G	SYSTEMS TROUBLESHOOTING	0.42	10	10.00	52.29	62.29
WBEL 5H	AUTOMATIC INPUT DEVICES	0.42	10	10.00	52.29	62.29
WBEL 5J	ELECTRONIC SENSORS	0.33	8	10.00	41.09	51.09
WBEL 5K	BASIC TIMER CONTROL	0.33	8	10.00	41.09	51.09
WBEL 5L	TIMERS & COUNTERS	0.25	6	10.00	31.13	41.13
	UNIT TOTAL	4.59	110	110.00	571.48	681.48
UNIT 7	ROTATING ELECTRIC MACHINES					
WBEL 7A	DC SERIES MOTORS	0.25	6	10.00	31.13	41.13
WBEL 7B	DC SHUNT & COMPOUND MOTORS	0.33	8	10.00	41.09	51.09
WBEL 7C	MOTOR SPEED & TORQUE	0.33	8	10.00	41.09	51.09
WBEL 7D	MOTOR PERFORMANCE	0.25	6	10.00	31.13	41.13
WBEL 7E	SPLIT PHASE MOTORS	0.25	6	10.00	31.13	41.13
WBEL 7F	CAPACITOR START MOTORS	0.25	6	10.00	31.13	41.13
WBEL 7G	PERMANENT CAPACITOR MOTORS	0.25	6	10.00	31.13	41.13
WBEL 7H	THREE-PHASE MOTORS	0.33	8	10.00	41.09	51.09
	UNIT TOTAL	2.24	54	80.00	278.92	358.92
UNIT 8	POWER DISTRIBUTION SYSTEMS					
WBEL 8A	POWER GENERAT & DISTRIBUTION	0.33	8	10.00	41.09	51.09
WBEL 8B	ELECTRICAL WIRING TECHNIQUES	0.33	8	10.00	41.09	51.09
WBEL 8C	WIRING SYSTEM INSTALLATION	0.42	10	10.00	52.29	62.29
WBEL 8D	INTRO TO RACEWAYS	0.42	10	10.00	52.29	62.29
WBEL 8E	BASIC CONDUIT BENDING	0.25	6	10.00	31.13	41.13
WBEL 8F	ADVANCED RACEWAYS	0.25	6	10.00	31.13	41.13
WBEL 8G	CONDUCT & OVERCURRENT PROTECT	0.25	6	10.00	31.13	41.13
WBEL 8H	CONDUIT SIZING & WIRE PULLING	0.33	8	10.00	41.09	51.09
	UNIT TOTAL	2.58	62	80.00	321.24	401.24
UNIT 9	FACILITY MAINTENANCE					
INEL 9A	PLANS & SITEWORK	0.25	6	15.00	31.13	46.13
INEL 9B	INDUSTRIAL POWER SYSTEMS	0.42	10	15.00	52.29	67.29
INEL 9C	SIGNALING SYSTEMS	0.25	6	5.00	31.13	36.13
INEL 9D	MOTORS, CONTROLLERS & INSTALLA	0.33	8	5.00	41.09	46.09
INEL 9E	SPECIAL EQUIPMENT & HVAC	0.33	8	5.00	41.09	46.09
INEL 9F	INDUSTRIAL HAZARDOUS LOCATIONS	0.25	6	5.00	31.13	36.13
INEL 9G	SINGLE PHASE TRANSFORMERS	0.33	8	15.00	41.09	56.09
INEL 9H	3 PHASE TRANSFORMERS	0.50	12	15.00	62.25	77.25
INEL 9J	NEC TRANSFORMER REQUIREMENTS	0.25	6	5.00	31.13	36.13
INEL 9K	EMERGENCY ELECTRICAL SYSTEMS	0.25	6	5.00	31.13	36.13
	UNIT TOTAL	3.16	76	90.00	393.46	483.46

(All costs are subject to change without notice. Please call 269-965-4137 to verify.)

INDUSTRIAL ELECTRICITY/ELECTRONICS PROGRAM

PACKET NUMBER	PACKET TITLE	CRED	CONT HOURS	LAB FEES	TUITION	TOTAL COST
UNIT 10	ELECTRICAL CONTROL WIRING					
WBEL 10A	ELECTRICAL CONTROL WIRING	0.42	10	10.00	52.29	62.29
WBEL 10B	ELECTRICAL CONTROL SYSTEMS	1.00	24	25.00	124.50	149.50
	UNIT TOTAL	1.42	34	35.00	176.79	211.79
UNIT 11	INDUSTRIAL ELECTRONICS					
INEL 11A	USING THE OSCILLOSCOPE	0.67	16	5.00	83.42	88.42
INEL 11B	METERS FOR ELECTRONICS	0.33	8	5.00	41.09	46.09
INEL 11C	ELECTRONIC SOLDERING	0.25	6	35.00	31.13	66.13
INEL 11D	SOLDERING PC BOARDS	0.25	6	35.00	31.13	66.13
INEL 11E	DIODES	0.25	6	5.00	31.13	36.13
INEL 11F	POWER SUPPLIES	0.50	12	10.00	62.25	72.25
INEL 11G	PHOTO DEVICES	0.33	8	5.00	41.09	46.09
INEL 11H	SOLID STATE DEVICES	0.83	20	5.00	103.34	108.34
INEL 11J	ELECTRONIC TIMING	0.33	8	5.00	41.09	46.09
INEL 11K	AMPLIFIERS	0.83	20	5.00	103.34	108.34
INEL 11L	DIGITAL LOGIC FUNDAMENTALS	0.50	12	5.00	62.25	67.25
INEL 11M	DIGITAL LOGIC APPLICATIONS	0.42	10	5.00	52.29	57.29
INEL 11N	PROXIMITY SWITCHING	0.17	4	5.00	21.17	26.17
INEL 11P	PHOTOELECTRIC DEVICES	0.17	4	5.00	21.17	26.17
INEL 11Q	FIBER OPTICS FUNDAMENTALS	0.33	8	5.00	41.09	46.09
INEL 11R	FIBER OPTICS-LAB	0.25	6	5.00	31.13	36.13
	UNIT TOTAL	6.41	154	145.00	798.11	943.11
UNIT 12	PROGRAM LOGIC CONTROLLERS 1					
WBEL 12A	INTRO TO PROGRAM CONTROLLERS	0.25	6	10.00	31.13	41.13
WBEL 12B	BASIC PLC PROGRAMMING	0.50	12	10.00	62.25	72.25
WBEL 12C	PLC MOTOR CONTROL	0.50	12	10.00	62.25	72.25
WBEL 12D	DISCRETE I/O INTERFACING	0.33	8	10.00	41.09	51.09
WBEL 12E	INTRO TO PLC TROUBLESHOOTING	0.33	8	10.00	41.09	51.09
WBEL 12F	PLC SYSTEMS TROUBLESHOOTING	0.33	8	10.00	41.09	51.09
	UNIT TOTAL	2.24	54	60.00	278.90	338.90
	PROGRAM TOTAL	32.48	781	906.00	4044.14	4950.14

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Electrical Safety

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor at any time you need assistance.

OBJECTIVE: The electrician must work on high voltages as well as low voltages. Sometimes, it is necessary to work in situations that are electrically "hot". This packet describes fundamental safety procedures that will make your job safer for you and your fellow workers.

LEARNING ACTIVITIES:

1) READ: **Information Sheets**, "Electrical Safety Precautions"

2) VIEW: Bergwall, video's:
"Electricity Can Kill", #E22 1
"The Shock Emergency", #E22 2
"The Importance of Grounding", #E22 3
"Emergency Response", #E22 4

3) ARRANGE: to complete this module by going through the **Check-Out Activities**.

CHECK-OUT ACTIVITIES:

⇒ Given questions, written and/or oral the student must answer questions on electrical safety with 100% accuracy.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Mathematics I

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. Whe you think you understand the information, proceed into the **Check-Out Activities**. See the Instructor anytime you need help.

OBJECTIVE: As an electrician you will encounter times when the use of mathematics will help you to solve problems. In this module you will work with decimals.

LEARNING ACTIVITIES:

1) RECEIVE & REVIEW: problems on decimals by practicing problems in the Xerox copies of Practical Problems in Mathematics for Electricians.

NOTE: ONLY WORK A FEW SAMPLE PROBLEMS IN EACH UNIT TO SEE IF YOU HAVE THE SKILLS TO MOVE ONTO THE NEXT UNIT.

2) CHECK: yourself by completing some of the problems, checking your answers with the answer key attached to the xerox copies.

3) ARRANGE: to complete this module by going through the **Check-Out Activities.**

CHECK-OUT ACTIVITIES:

⇒ Given mathematical problems with decimals, the student will solve these problems with 90% accuracy. The student will correct any answers missed on the **Final Check-Out**.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Mathematics II

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand, proceed into the **Check-Out Activities.** See the Instructor anytime you need help.

OBJECTIVE: As an electrician you will encounter times when the use of mathematical formulas are needed to solve electrical problems. In this module you will work with formulas in problem solving.

LEARNING ACTIVITIES:

1) VIEW: video, "Simple Equations", TS-258 by National Audio-Visual Center

2) REVIEW: Practical Problems in Mathematics for Electricians, by practicing problems on pages 104-120, Units 35-37

NOTE: Only work a few problems in each unit to see if you have the skills to move on to the next unit. ONLY WORK THE INDICATED PROBLEMS IN THESE CHAPTERS.

NOTE: IF YOU NEED FURTHER ASSISTANCE SEE YOUR INSTRUCTOR.

4) ARRANGE: to complete this module by completing the **Check-Out Activities.**

CHECK-OUT ACTIVITIES:

⇒ Given mathematical problems with formulas, the student will solve these problems with 90% accuracy. The student will correct all errors.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Mathematics III

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor at any time you need assistance.

OBJECTIVE: As an electrician you will encounter problems where the use of mathematics will help you solve these problems. In this module you will learn basic trigonometry functions.

LEARNING ACTIVITIES:

1) READ: Standard Textbook of Electricity, by Herman, Third Edition, pages 412-422, Unit 14, "Basic Trigonometry and Vectors" (2nd Edition, pages 394-405)

2) CHECK: yourself by completing the *Review Questions* on pages 430-432 and *Practice Problems* on page 433, from Standard Textbook of Electricity (2nd Edition, page 433)

3) ARRANGE: to complete this module by completing the **Check-Out Activities**.

OPTIONAL READING: Elementary Technical Mathematics, by Ewen & Nelson, pages 406-412, "Trigonometric Ratios"

CHECK-OUT ACTIVITIES:

⇒ Given mathematical problems, the student will use basic trigonometry functions to solve them with 90% accuracy. The student will correct all errors.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Electrical Theory

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor at any time you need assistance.

OBJECTIVE: The basic principles of electrical energy must be studied and thoroughly understood. The effects of electricity can be predicted using Electron Theory. In this module you will learn the basic principles of electrical energy.

LEARNING ACTIVITIES:

THE STUDENT WILL RECEIVE HIS/HER COPY OF **Standard Textbook Of Electricity**, a *LAB-MANUAL*, and a *HAND-OUT & WORK-SHEET MANUAL*. YOU WILL NEED TO SIGN FOR THESE, THEY ARE YOURS TO KEEP. THEY WILL BE NEEDED FOR DIFFERENT PARTS OF THE PROGRAM.

1) READ: Standard Textbook of Electricity, Third Edition, by S. Herman, Unit 1, pages 28-50, "Atomic Structure" (2nd Edition, pages 2-22)

2) COMPLETE: the *Review Questions*, on page 50, in Standard Textbook of Electricity (2nd Edition, page 23)

3) VIEW: Bergwall video: "Electron Theory", #832-1

4) ARRANGE: to complete this module by going through the **Check-Out Activities.**

CHECK-OUT ACTIVITIES:

⇒ The student will complete and turn-in *Review Questions* from Standard Textbook of Electricity.

⇒ Given questions on Electrical Energy the student will answer with 90% accuracy.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Static Electricity

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor at any time you need assistance.

OBJECTIVE: Static electricity can be both helpful and harmful. This module will show how static electricity can be used for such applications as spray painting and dust removal. This module will also show you how static must be reduced to prevent explosions and problems in processing.

LEARNING ACTIVITIES:

1) READ: Standard Textbook of Electricity, Third Edition, by S. Herman, Unit 3, pages 79-92, "Static Electricity" (2nd Edition pages 54-68)

2) COMPLETE: the *Review Questions,* on pages 92 and 93, in Standard Textbook of Electricity (2nd Edition pages 68 & 69)

3) ARRANGE: to complete this module by going through the **Check-Out Activities.**

CHECK-OUT ACTIVITIES:

⇒ The student will complete and turn-in *Review Questions* from Standard Textbook of Electricity.

⇒ Given questions on Static Electricity the student will answer with 90% accuracy.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Calculators & Electronics

DIRECTIONS: Read the Objective and complete the Learning Activities described below. When you think you understand the information, proceed into the Check-Out Activities. See your Instructor any time you need assistance.

OBJECTIVE: The calculator has become a valuable aid to students, technicians, and electricians in the electrical field. In this module you will learn to take advantage of this modern, useful tool.

LEARNING ACTIVITIES:

1) READ: Standard Textbook of Electricity, by S. Herman, Appendix G, Third Edition, pages 1029-1033, "Scientific Notation" (2nd Edition, pages 1040-1043)

2) READ: **HAND-OUT's**, "Calculators & Electronics" and "Laws of Exponents" These are in your *Hand-Out & Work-Sheet Manual*

3) ARRANGE: to complete this module by going through the **Check-Out Activities.**

CHECK-OUT ACTIVITIES:

⇒ Given questions and/or problems, the student will use the calculator to solve problems or answer questions with 90% accuracy.

PROGRAM: Industrial Electricity/Electricity

TASK TITLE: Devices & Symbols

DIRECTIONS: Read the **Objective** and **Check-Out Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor any time you need assistance.

OBJECTIVE: Electronic symbols and devices are important in the study of electricity/electronics. In this module you will learn about symbols, devices, and more about conductors, insulators, and electron flow.

LEARNING ACTIVITIES:

1) READ: Standard Textbook of Electricity, Third Edition, by S. Herman, Unit 6, pages 112-131, "Resistors" (2nd Edition, pages 92-110)
pages 3-27, "Safety Overview"

2) COMPLETE: the *Review Questions*, on page 132, and *Practice Problems* on page 133, in Standard Textbook of Electricity, by S. Herman (2nd Edition pages 110 &133)

3) VIEW: Bergwall video: "Circuits, Symbols, & Diagrams", #832-2
"Resistors & Rheostats", #832-7

4) COMPLETE: **LAB EXERCISE** for this module

5) ARRANGE: to complete this module by going through the **Check-Out Activities.**

CHECK-OUT ACTIVITIES:

⇒ The student will complete and turn- in *Review Questions* and *Practice Problems* from Standard Textbook of Electricity.

⇒ The student will complete **Lab Exercise** with acceptable accuracy as determined by the Instructor.

⇒ Given questions on Devices and Symbols the student will answer with 90% accuracy.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Multimeter (VOM)

DIRECTIONS: Read the **Objective** and **Check-Out Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor any time you need assistance.

OBJECTIVE: The multimeter is one of the most widely used meters today. In this module, you will learn to use the multimeter.

LEARNING ACTIVITIES:

1) READ: Standard Textbook of Electricity, by S. Herman, Third Edition, Unit 9, pages 245-298, "Measuring Instruments" (2nd Edition, pages 226-281)

2) READ: **HAND-OUT**, "Laws"

3) VIEW: video's: "Meter Reading & Ohm's Law", #832-3 by Bergwall
"Digital Multimeter Principles" by Fluke

4) CHECK: **HAND-OUT**, "Reading Multimeters", answers can be found in the A.R.C.

5) COMPLETE: **LAB EXERCISE** for this module.

6) ARRANGE: to complete this module by going through the **Check-Out Activities**.

CHECK-OUT ACTIVITIES:

⇒ Complete **Hand-Out** on "Multi-meters".
⇒ The student will complete **Lab Exercises** with acceptable accuracy as determined by the Instructor.
⇒ Given questions on multi-meters the student will answer with 90% accuracy.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Ohm's Law

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See the Instructor any time you need help.

OBJECTIVE: The information you have received up to this point has been in the form of an introduction. To understand electrical theory, it is necessary to become familiar with basic circuit applications. In this module you will become familiar with basic circuitry and the mathematical laws that apply to them.

LEARNING ACTIVITIES:

1) READ: Standard Textbook of Electricity, by S. Herman, Third Edition, Unit 2, pages 51-76 "Electrical Quantities and Ohm's Law" (2nd Edition, pages 27-49)

2) READ: **HAND-OUT**'s, "Electricity/Electronics Formula Wheel" and "Appendix D/Alternating Current Formulas"

3) COMPLETE: the *Review Questions*, on pages 76 and 77, and the *Practice Problems* on page 78, in Standard Textbook of Electricity (2nd Edition, pages 49-51)

4) VIEW: Bergwall, video: "Working with Ohm's Law", F13-#2

5) COMPLETE: **LAB EXERCISE** for this module

6) ARRANGE: to complete this module by going through the **Check-Out Activities.**

CHECK-OUT ACTIVITIES:

⇒ The student will complete and turn-in *Review Questions* and *Practice Problems* from Standard Textbook of Electricity.

⇒ The student will complete **Lab Exercises** with acceptable accuracy as determined by the Instructor.

⇒ Given questions on Ohm's Law the student will answers with 90% accuracy

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Series Circuits

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor at any time you need assistance.

OBJECTIVE: It is necessary to master series circuits before progressing to more complex circuitry. In this module you will continue to work with Ohm's and Kirchoff's Laws, and you will be introduced to the topic of power dissipation.

LEARNING ACTIVITIES:

1) READ: Standard Textbook of Electricity, by S. Herman, Third Edition, Unit 6, pages 135-159, "Series Circuits" (2nd Edition, pages 114-138)

2) COMPLETE: the *Review Questions* on pages 160 and 161, and the *Practice Problems* on page 1161, in Standard Textbook of Electricity (2nd Edition, pages 160-161)

3) READ: **HAND-OUT**, "Simplified Series and Parallel Rules"

4) COMPLETE: **WORK-SHEET,** "Series Circuits"

5) VIEW: Bergwall, video's: "Series Circuits ", E16-#1

6) COMPLETE: **LAB EXERCISE** for this module

7) ARRANGE: to complete this module by going through the **Check-Out Activities.**

CHECK-OUT ACTIVITIES:

⇒ The student will complete and turn-in *Review Questions* and *Practice Problems* from Standard Textbook of Electricity.

⇒ The student will complete **Lab Exercises** with acceptable accuracy as determined by the Instructor.

⇒ Given questions on Series Resistive Circuits the student will answer with 90% accuracy.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Parallel Circuits

DIRECTIONS: Read the **Objective** and **Check-Out Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor any time you need assistance.

OBJECTIVE: It is necessary to master parallel circuits, before progressing to more complex circuitry. In this module you will continue to use Ohm's and Kirchoff's Laws and learn to analyze a parallel resistive circuit.

LEARNING ACTIVITIES:

1) READ: Standard Textbook of Electricity, by s. Herman, Third Edition, Unit 7, pages 162-184, "Parallel Circuits" (2nd Edition, pages 142-164)

2) COMPLETE: the *Review Questions* on page 184 and 185, and the *Practice Problems* on pages 186 and 187, in Standard Textbook of Electricity (2nd Edition, pages 164-166)

3) COMPLETE: **WORK-SHEET**, "Series and Parallel Circuits"

4) VIEW: Bergwall video's: "Parallel Circuits" E16-#3

5) COMPLETE: **LAB EXERCISE** for this module

6) ARRANGE: to complete this module by going through the **Check-Out Activities**.

CHECK-OUT ACTIVITIES:

⇒ The student will complete and turn-in *Review Questions* and *Practice Problems* from Standard Textbook of Electricity.

⇒ The student will complete **Lab Exercises** with acceptable accuracy as determined by the Instructor.

⇒ Given questions on Parallel Resistive Circuits the student will answer with 90% accuracy.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Series & Parallel Circuits

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See the Instructor any time you need help.

OBJECTIVE: Now that you understand the principles of both series and parallel circuits, you will learn to work with combination series/parallel circuits.

LEARNING ACTIVITIES:

1) READ: Standard Textbook of Electricity, by S. Herman, Third Edition, Unit 8, pages 188-211, "Combination Circuits" (2nd Edition, pages 170-194)

***NOTE:** Disregard all information and problems on "Nortons Theorem" and "Thevenin's Theorems".*

2) COMPLETE: in Standard Textbook of Electricity, the *Review Questions* on page 234 questions 1-4, (2nd Ed. pages 215-217) and the *Practice Problems* on pages 238-239, "Series-Parallel Circuits", problems 1-3 (Problem 1, See Instructor) (2nd Ed. pages 219-220)
pages 239-240, "Parallel-Series Circuits, problems 4-6 (Problem 4, See Instructor) (2nd Ed. pages 220-221)
pages 240-241, "Combination Circuits", problems 7 & 8 (2nd Ed. pages 221-222)

3) VIEW: Bergwall video: "Resistors & Complex Circuits", #801-6

4) COMPLETE: **LAB EXERCISE** for this module

5) ARRANGE: to complete this module by going through the **Check-Out Activities**.

CHECK-OUT ACTIVITIES:

⇒ The student will complete and turn-in *Review Questions* and *Practice Problems* from Standard Textbook of Electricity.
⇒ The student will complete **Lab Exercises** with acceptable accuracy as determined by the Instructor.
⇒ Given questions on Series/Parallel Circuits the student will answer with 90% accuracy.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Magnetism

DIRECTIONS: Read the **Objective** and **Check-Out Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor any time you need assistance.

OBJECTIVE: Magnetism, like electricity, is another invisible force that has been known for centuries. In this module you will learn about magnetism, its properties, and applications.

LEARNING ACTIVITIES:

1) READ: Standard Textbook of Electricity, by S. Herman, Third Edition, Unit 4, pages 94-110, "Magnetism" (2nd Edition, pages 72-87)

2) COMPLETE: the *Review Questions* on page 111, in Standard Textbook of Electricity (2nd Edition, pages 88-89)

3) VIEW: Bergwall video: "Magnetism and Electromagnetism", #802-6

4) ARRANGE: to complete this module by going through the **Check-Out Activities**.

CHECK-OUT ACTIVITIES:

⇒ The student will complete and turn-in *Review Questions* from Standard Textbook of Electricity.

⇒ Given questions on Magnetism the student will answer with 90% accuracy.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Alternating Current

DIRECTIONS: Read the Objective and complete the Learning Activities described below. When you think you understand the information, proceed into the Check-Out Activities. See your Instructor any time you need assistance.

OBJECTIVE: Alternating current is more widely used because of some of its desirable characteristics. In this module you will become familiar with these characteristics of alternating current (AC).

LEARNING ACTIVITIES:

1) READ: Standard Textbook of Electricity, by S. Herman, Third Edition, Unit 15, pages 434-454, "Alternating Current" (2nd Edition, pages 410-429)

2) COMPLETE: the *Review Questions* on pages 454 & 455, and the *Practice Problems* on pages 456 & 457, in Standard Textbook of Electricity (2nd Edition, pages 430-431)

3) ARRANGE: to complete this module by going through the **Check-Out Activities**.

CHECK-OUT ACTIVITIES:

⇒ The student will complete and turn-in *Review Questions* and *Practice Problems* from Standard Textbook of Electricity.

⇒ Given questions on Alternating Current, the student will answer with 90% accuracy.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: The Oscilloscope

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor at any time you need assistance.

OBJECTIVE: The oscilloscope can be a useful tool in Electricity/Electronics. In this module you will learn about the operation and uses of the oscilloscope.

LEARNING ACTIVITIES:

1) READ: Standard Textbook of Electricity, by S. Herman, Second Edition, Unit 9, pages 285-296, section 9-16 "The Oscilloscope" (2nd Edition, pages 265-275)

2) VIEW: Bergwall, video's: Series #802; Basic Electricity and Electronics: AC,
"Oscilloscopes and How to Use Them", #3
"Oscilloscope Operation-Measuring Voltage", #4
"Oscilloscope Operation-Determining Frequency", #5

3) COMPLETE: **LAB EXERCISE** for this module

4) ARRANGE: to complete this module by going through the **Check-Out Activities.**

CHECK-OUT ACTIVITIES:

⇒ The student will complete **Lab Exercises** with acceptable accuracy as determined by the Instructor.

⇒ Given questions on the Oscilloscope in the **Lab** the student will answer with 90% accuracy.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Inductance

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor at any time you need assistance.

OBJECTIVE: Certain factors cause actions in AC circuits that are not present in DC circuits. This module will cover one of these factors.

LEARNING ACTIVITIES:

1) READ: Standard Textbook of Electricity, by S. Herman, Third Edition,
   Unit 13, pages 388-410, "Magnetic Induction"
   Unit 16, pages 459-477, "Inductance in AC Circuits" (2nd Edition, pages 434-450)
   Unit 17, pages 480-505, "Resistive-Inductive Series Circuits" (2nd Edition, pages 456-486)
   Unit 18, pages 508-525, "Resistive-Inductive Parallel Circuits" (2nd Edition, pages 492-508)

2) COMPLETE: the *Practice Problems* on:
   pages 410-411, "Magnetic Induction"
   pages 479-480, "Inductance in AC Circuits" (2nd Edition, pages 452-453)
   pages 506-507, "Resistive-Inductive Series Circuits" (2nd Edition, pages 488-489)
   pages 526-527, "Resistive-Inductive Parallel Circuits" (2nd Edition, pages 510-511)
   from Standard Textbook of Electricity

3) VIEW: Bergwall video: "Inductors and Inductive Reactance", #802-7

4) COMPLETE: **LAB EXERCISE** for this module

5) ARRANGE: to complete this module by going through the **Check-Out Activities.**

CHECK-OUT ACTIVITIES:

⇒ The student will complete and turn-in *Practice Problems* from Standard Textbook of Electricity.
⇒ The student will complete **Lab Exercises** with acceptable accuracy as determined by the Instructor.
⇒ Given questions on Inductance, the student will answer with 90% accuracy.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Capacitance

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor at any time you need assistance.

OBJECTIVE: Capacitors are used as filters, tuners, DC blocks, timers, and wave-shapers. This device is another factor in actions in an AC circuit. In this module you will cover the actions of this device in AC circuitry.

LEARNING ACTIVITIES:

1) READ: Standard Textbook of Electricity, by S. Herman, Third Edition,
   Unit 19, pages 529-561, "Capacitors" (2nd Edition, pages 514-545)
   Unit 20, pages 563-583, "Capacitance in AC Circuits" (2nd Edition, pages 550-569)
   Unit 21, pages 585-599, "Resistive-Capacitive Series Circuits" (2nd Edition, pages 574-588)
   Unit 22, pages 602-615, "Resistive-Capacitive Parallel Circuits" (2nd Edition, pages 594-607)

2) COMPLETE: from Standard Textbook of Electricity the *Practice Problems* on:
   page 562, "Capacitors" (2nd Edition, page 547)
   page 584, "Capacitance in AC Circuits" (2nd Edition, pages 570-571)
   pages 600-601, "Resistive-Capacitive Series Circuits" (2nd Edition, pages 590-591)
   pages 616-617, "Resistive-Capacitive Parallel Circuits" (2nd Edition, pages 608-609)

3) VIEW: Bergwall, video "Capacitors and Capacitive Reactance", #802-9

4) COMPLETE: **LAB EXERCISE** for this module

5) ARRANGE: to complete this module by going through the **Check-Out Activities.**

CHECK-OUT ACTIVITIES:

⇒ The student will complete and turn-in *Practice Problems* from Standard Textbook of Electricity.

⇒ The student will complete **Lab Exercises** with acceptable accuracy as determined by the Instructor.

⇒ Given three (3) statements on Capacitance the student will choose one to write a report on.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: RCL Circuits

DIRECTIONS: Read the Objective and complete the Learning Activities described below. When you think you understand the information, proceed into the Check-Out Activities. See your Instructor any time you need assistance.

OBJECTIVE: It's very common in AC circuits to contain resistance, inductors, and capacitors. In this module you will learn to solve AC circuits that may contain these devices.

LEARNING ACTIVITIES:

1) READ: Standard Textbook of Electricity, by S. Herman, Third Edition,
   Unit 23, pages 619-637, "Resistive-Inductive-Capacitive Series Circuits"
   (2nd Edition, pages 612-631)
   Unit 24, pages 640-660, "Resistive-Inductive-Capacitive Parallel Circuits"
   (2nd Edition, pages 636-657)

2) COMPLETE: from Standard Textbook of Electricity the *Practice Problems* on:
   pages 638-639, "Resistive-Inductive-Capacitive Series Circuits" (2nd Edition, pages 632-633)
   pages 662-663, "Resistive-Inductive-Capacitive Parallel Circuits" (2nd Edition, pages 658-659)

3) COMPLETE: **LAB EXERCISE** for this module

4) ARRANGE: to complete this module by going through the **Check-Out Activities**

CHECK-OUT ACTIVITIES:

⇒ The student will complete and turn-in *Practice Problems* from Standard Textbook of Electricity.
⇒ The student will complete **Lab Exercises** with acceptable accuracy as determined by the Instructor.
⇒ Given questions on RCL Circuits the student will answer with 90% accuracy.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Conduction

DIRECTIONS: Read the **Objective** and **Check-Out Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor any time you need assistance.

OBJECTIVE: The conduction of electric current through a gas or liquid is somewhat different than conduction through a wire. In this module you will become familiar with this process.

LEARNING ACTIVITIES:

1) READ: Standard Textbook of Electricity, by S. Herman, Third Edition, Unit 11, pages 339-351, "Conduction in Liquids and Gases" (2nd Edition, pages 318-330)

2) COMPLETE: the *Review Questions* on pages 351-352, from Standard Textbook of Electricity

3) ARRANGE: to complete this module by going through the **Check-Out Activities**.

CHECK-OUT ACTIVITIES:

⇒ The student will complete and turn-in *Review Questions* from Standard Textbook of Electricity.
⇒ The student will design a **Lab Experiment** to show one of the principles in this Unit.
⇒ Given questions on Conduction in Liquids and Gases, the student will answer with 90% accuracy.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Theory Overview

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor at any time you need assistance.

OBJECTIVE: In this module you will complete the electrical theory overview by examination. It is important to have a good foundation on theory before proceeding to the other electrical areas.

LEARNING ACTIVITIES:

1) REVIEW: in Standard Textbook of Electricity, by S. Herman, Third Edition (2nd Edition)
   - Appendix G, "Scientific Notation"
   - Unit 5, "Resistors"
   - Unit 9, "Measuring Instruments"
   - Unit 2, "Ohm's Law"
   - Unit 6, "Series Circuits"
   - Unit 7, "Parallel Circuits"
   - Unit 8, "Combination Circuits"
   - Unit 4, "Magnetism"
   - Unit 15, "Alternating Current"
   - Unit 9, "Measuring Instruments"
   - Unit 16, "Inductance in AC Circuits"
   - Unit 17, "Resistive-Inductive Series Circuits"
   - Unit 18, "Resistive-Inductive Parallel Circuits"
   - Unit 19, "Capacitors"
   - Unit 20, "Capacitance in AC Circuits"
   - Unit 21, "Resistive-Capacitive Series Circuits"
   - Unit 22, "Resistive-Capacitive Parallel Circuits"
   - Unit 23, "Resistive-Inductive-Capacitive Series Circuits"
   - Unit 24, "Resistive-Inductive-Capacitive Parallel Circuits"
   - Unit 11, "Conduction in Liquids and Gases"

2) REVIEW: all **HAND-OUTS, LAB EXERCISES, and any other related material.**

3) ARRANGE: to complete this module by going through the **Check-Out Activities**

CHECK-OUT ACTIVITIES:

⇒ The student will complete a final written and lab exams, which will be given to them by the **Instructor in the LAB.**

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: General Wiring & Fundamentals

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See the Instructor any time you need help.

OBJECTIVE: After completing this module, the student will be able to:

* Describe the purpose for the N.E.C.
* Apply fundamentals of basic electricity.
* Use the N.E.C. to identify guide lines for safe wiring practices.

LEARNING ACTIVITIES:

1) READ: Interpreting the National Electrical Code, 6th Edition, by Surbrook & Althouse, Unit 1, "General Wiring & Fundamentals", pages 1-40

2) COMPLETE: *Student Practice Problems* in Unit 1, of Interpreting the NEC

3) READ: National Electrical Code 2002, the recommended articles

4) READ: Delmar's Standard Textbook of Electricity, Third Edition, by Herman, Unit 10, pages 305-331, "Using Wire Tables and determining Conductor Sizes"

5) COMPLETE: the *Review Questions* on pages 335 & 336 in Delmar's Standard Textbook of Electricity

6) ARRANGE: to complete this module by going through the **Check-Out Activities**

CHECK-OUT ACTIVITIES:

- The student will complete and turn-in both BEGINNING and ADVANCED *Answer Sheets for #1* from Interpreting the NEC, by Surbrook & Althouse, pages 41-50.
- The student will complete the **Lab Assignments** for this module.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Wire, Raceway, & Box Sizing

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See the Instructor any time you need help.

OBJECTIVE: After completing this module, the student will be able to:

* Determine wire and conduit sizing.
* Determine sizes for junction boxes, pull boxes, and conduit bodies.
* Understand the NEC requirements for wire, raceway, and box sizing.

LEARNING ACTIVITIES:

1) READ: Interpreting the National Electrical Code, 6th Edition, by Surbrook & Althouse, Unit 2, "Wire, Raceway, & Box Sizing", pages 51-82

2) COMPLETE: *Student Practice Problems* in Unit 2, of Interpreting the NEC

3) READ: National Electrical Code 2002, the recommended articles

4) VIEW: Video, "Metal Conduit Bending" by The Greenlee Co

5) COMPLETE: **Lab Assignments** you receive from your Instructor

4) ARRANGE: to complete this module by going through the **Check-Out Activities**.

CHECK-OUT ACTIVITIES:

⇒ The student will complete and turn-in both BEGINNING and ADVANCED *Answer Sheets for #2* from Interpreting the NEC, by Surbrook & Althouse, pages 83-94.

⇒ The student will complete the **Lab Assignments** for this module.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Branch Circuits

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See the Instructor any time you need help.

OBJECTIVE: After completing this module, the student will be able to:

* Determine size and number of branch circuits for various installations.
* Use the National Electrical Code to insure proper application of branch circuit wiring.

LEARNING ACTIVITIES:

1) READ: Interpreting the National Electrical Code, 6th Edition, by Surbrook & Althouse, Unit 3, "Outlets, Lighting, Appliances, & Heating", pages 95-118

2) COMPLETE: *Student Practice Problems* in Unit 3, of Interpreting the NEC

3) READ: National Electrical Code 2002, the recommended articles

4) RECEIVE: Home Wiring, by Step by Step Guide Books

5) COMPLETE: **Lab Assignments** you receive from your Instructor

6) ARRANGE: to complete this module by going through the **Check-Out Activities**.

CHECK-OUT ACTIVITIES:

⇒ The student will complete and turn-in both BEGINNING and ADVANCED *Answer Sheets for #3* from Interpreting the NEC, by Surbrook & Althouse, pages 119-128.

⇒ The student will complete the **Lab Assignments** for this module.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Service & Feeder Calculations

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See the Instructor any time you need help.

OBJECTIVE: After completing this module, the student will be able to:

* Calculate service and feeder sizes.
* Demonstrate the requirements for proper service and feeder installation.

LEARNING ACTIVITIES:

1) READ: Interpreting the National Electrical Code, 6th Edition, by Surbrook & Althouse, Unit 4, "Outlets, Lighting, Appliances, & Heating", pages 129-149

2) COMPLETE: *Student Practice Problems* in Unit 4, of Interpreting the NEC

3) READ: National Electrical Code 2002, the recommended articles

4) ARRANGE: to complete this module by going through the **Check-Out Activities**.

CHECK-OUT ACTIVITIES:

⇒ The student will complete and turn-in both BEGINNING and ADVANCED *Answer Sheets for #4* from Interpreting the NEC, by Surbrook & Althouse, pages 150-158.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Grounding & Bonding

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See the Instructor any time you need help.

OBJECTIVE: After completing this module, the student will be able to:

* Explain the purpose for electrical systems, equipment grounding and bonding.
* Draw and label single phase and three phase electrical systems.
* Determine the proper conductor sizes for grounding and bonding.

LEARNING ACTIVITIES:

1) READ: Interpreting the National Electrical Code, 6th Edition, by Surbrook & Althouse, Unit 5, "Gounding & Bonding", pages 159-183

2) COMPLETE: *Student Practice Problems* in Unit 5, of Interpreting the NEC

3) READ: National Electrical Code 2002, the recommended articles

4) COMPLETE: **Lab Assignments** you receive from your Instructor

5) ARRANGE: to complete this module by going through the **Check-Out Activities.**

CHECK-OUT ACTIVITIES:

⇒ The student will complete and turn-in both BEGINNING and ADVANCED *Answer Sheets for #5* from Interpreting the NEC, by Surbrook & Althouse, pages 184-195

⇒ The student will complete the **Lab Assignments** for this module.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Overcurrent Protection

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See the Instructor any time you need help.

OBJECTIVE: After completing this module, the student will be able to:

* Explain two types of overcurrent conditions.
* Explain two types of electrical faults.
* Calculate voltage drop for conductors.

LEARNING ACTIVITIES:

1) READ: Interpreting the National Electrical Code, 6th Edition, by Surbrook & Althouse, Unit 6, "Overcurrent Protection", pages 197-223

2) COMPLETE: *Student Practice Problems* in Unit 6, of Interpreting the NEC

3) READ: National Electrical Code 2002, the recommended articles

4) VIEW: Video's, by Gold Shawmut:
   "Circuit Protection - American Ending"
   "AJT/IEC Contractor Protection"
   "MIS - Application"

5) RECEIVE: EC & M Handout, Arc Fault Circuit Interrupters by Square D Co.

6) ARRANGE: to complete this module by going through the **Check-Out Activities**.

CHECK-OUT ACTIVITIES:

⇒ The student will complete and turn-in both BEGINNING and ADVANCED *Answer Sheets for #6* from Interpreting the NEC, by Surbrook & Althouse, pages 224-234.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Motor - Circuit Wiring

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See the Instructor any time you need help.

OBJECTIVE: After completing this module, the student will be able to:

* Size conductors, overload protection, fuses, and conduits for motors.
* Explain NEMA enclosure ratings.
* Draw a control circuit for a magnetic motor starter.

LEARNING ACTIVITIES:

1) READ: Interpreting the National Electrical Code, 6th Edition, by Surbrook & Althouse, Unit 7, "Motor Circuit Wiring", pages 235-259

2) COMPLETE: *Student Practice Problems* in Unit 7, of Interpreting the NEC

3) READ: National Electrical Code 2002, the recommended articles

4) ARRANGE: to complete this module by going through the **Check-Out Activities**.

CHECK-OUT ACTIVITIES:

⇒ The student will complete and turn-in both BEGINNING and ADVANCED *Answer Sheets for #7* from Interpreting the NEC, by Surbrook & Althouse, pages 260-271.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Transformers

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See the Instructor any time you need help.

OBJECTIVE: After completing this module, the student will be able to:

* Describe transformer fundamentals.
* Determine transformer capacity.
* Determine the minimum safe requirements for connecting transformers.

LEARNING ACTIVITIES:

1) READ: Interpreting the National Electrical Code, 6th Edition, by Surbrook & Althouse, Unit 8, "Transformers", pages 273-294

2) COMPLETE: *Student Practice Problems* in Unit 8, of Interpreting the NEC

3) READ: National Electrical Code 2002, the recommended articles

4) COMPLETE: **Lab Assignments** you receive from your Instructor

5) ARRANGE: to complete this module by going through the **Check-Out Activities**.

CHECK-OUT ACTIVITIES:

⇒ The student will complete and turn-in both BEGINNING and ADVANCED *Answer Sheets for #8* from Interpreting the NEC, by Surbrook & Althouse, pages 295-307.

⇒ The student will complete the **Lab Assignments** for this module.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Hazardous Locations

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See the Instructor any time you need help.

OBJECTIVE: After completing this module, the student will be able to:

* Explain the differences between Division 1, and Division 2, and classes of hazardous locations.
* Explain or demonstrate the special requirements for hazardous locations.

LEARNING ACTIVITIES:

1) READ: Interpreting the National Electrical Code, 6th Edition, by Surbrook & Althouse, Unit 9, "Hazardous Location Wiring", pages 309-326

2) COMPLETE: *Student Practice Problems* in Unit 9, of Interpreting the NEC

3) READ: National Electrical Code 2002, the recommended articles

4) VIEW: Video, "Electrical Connections in Hazardous Locations" by The Appleton Co.

5) ARRANGE: to complete this module by going through the **Check-Out Activities**.

CHECK-OUT ACTIVITIES:

⇒ The student will complete and turn-in both BEGINNING and ADVANCED *Answer Sheets for #9* from Interpreting the NEC, by Surbrook & Althouse, pages 327-336.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Health Care Facilities

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See the Instructor any time you need help.

OBJECTIVE: After completing this module, the student will be able to:

* Identify the two types of patient care areas of a health care facility.
* Describe installation requirements for these areas.
* Identify special equipment and devices listed for health care use.

LEARNING ACTIVITIES:

1) READ: Interpreting the National Electrical Code, 6th Edition, by Surbrook & Althouse, Unit 10, "Health Care Facilities", pages 337-347

2) COMPLETE: *Student Practice Problems* in Unit 10, of Interpreting the NEC

3) READ: National Electrical Code 2002, the recommended articles

4) ARRANGE: to complete this module by going through the **Check-Out Activities**.

CHECK-OUT ACTIVITIES:

⇒ The student will complete and turn-in both BEGINNING and ADVANCED *Answer Sheets for #10* from Interpreting the NEC, by Surbrook & Althouse, pages 348-356.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Emergency Power Systems

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See the Instructor any time you need help.

OBJECTIVE: After completing this module, the student will be able to:

* Determine proper installation requirements for stand-by generator systems.
* Explain the need for transfer systems and their operation.
* Explain the difference between a supervised and unsupervised fire alarm system.

LEARNING ACTIVITIES:

1) READ: Interpreting the National Electrical Code, 6th Edition, by Surbrook & Althouse, Unit 11, "Emergency and Alternate Power Systems", pages 357-387

2) COMPLETE: *Student Practice Problems* in Unit 11, of Interpreting the NEC.

3) READ: National Electrical Code 2002, the recommended articles

4) ARRANGE: to complete this module by going through the **Check-Out Activities**

CHECK-OUT ACTIVITIES:

⇒ The student will complete and turn-in both BEGINNING and ADVANCED *Answer Sheets for #11* from Interpreting the NEC, by Surbrook & Althouse, page 388-398.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Industrial Applications

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See the Instructor any time you need help.

OBJECTIVE: After completing this module, the student will be able to:

* Determine installation requirements for feeders, cables, cable trays, and conductors.
* Determine branch circuit requirements for cranes, hoist, and monorails.
* Explain wiring installation for various industrial applications.

LEARNING ACTIVITIES:

1) READ: Interpreting the National Electrical Code, 6th Edition, by Surbrook & Althouse, Unit 12, "Industrial Electrical Applications", pages 399-419

2) COMPLETE: *Student Practice Problems* in Unit 12, of Interpreting the NEC

3) READ: National Electrical Code 2002, the recommended articles

4) COMPLETE: **Lab Assignments** you receive from your Instructor

5) ARRANGE: to complete this module by going through the **Check-Out Activities**.

CHECK-OUT ACTIVITIES:

⇒ The student will complete and turn-in both BEGINNING and ADVANCED *Answer Sheets for #12* from Interpreting the NEC, by Surbrook & Althouse, pages 420-429.

⇒ The student will complete **Lab Assignments** for this module.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Special Application Wiring

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See the Instructor any time you need help.

OBJECTIVE: After completing this module, the student will be able to:

* Explain wiring methods and materials for special applications.
* Describe which Articles from the NEC apply to communication circuits and systems.
* Understand agricultural wiring methods.

LEARNING ACTIVITIES:

1) READ: Interpreting the National Electrical Code, 6th Edition, by Surbrook & Althouse, Unit 14, "Special Application Wiring", pages 459-479

2) COMPLETE: *Student Practice Problems* in Unit 14, of Interpreting the NEC

3) READ: National Electrical Code 2002, the recommended articles

4) ARRANGE: to complete this module by going through the **Check-Out Activities**

CHECK-OUT ACTIVITIES:

⇒ The student will complete and turn-in both BEGINNING and ADVANCED *Answer Sheets for #14* from Interpreting the NEC, by Surbrook & Althouse, pages 480-487.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: NEC Review

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See the Instructor any time you need help.

OBJECTIVE: After completing this module, the student will be able to:

* Solve electrical calculations.
* Find answers to questions from the NEC.
* Correctly complete electrical wiring calculations.
* Determine which Articles of the NEC require further work and understanding.

LEARNING ACTIVITIES:

1) COMPLETE: Interpreting the National Electrical Code, 6th Edition, by Surbrook & Althouse, Unit 15, "Review", pages 489-508, you must obtain 80% accuracy to complete this module.

3) ARRANGE: to complete this module by going through the **Check-Out Activities**.

CHECK-OUT ACTIVITIES:

- The student will complete and turn-in *Review Sheet Answer Sheet #15* from Interpreting the NEC, by Surbrook & Althouse, pages 489-508, 80% accuracy is minimum requirement to pass.
- See your Instructor for the Final Exam.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Introduction to Electric Motor Controls

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor at any time you need assistance.

OBJECTIVE:

1. Explain the importance of the equipment ground connection
2. Describe the function of five common standards associated with electrical control
3. Describe ten basic rules of electrical safety
4. Describe the purpose of the lockout/tag out system used in industry
5. Describe the operation of three-phase power
6. Describe the two most common three-phase voltage systems
7. Explain the function of neutral
8. Describe the operation of grounded and ungrounded systems
9. Describe two devices used to disconnect power to a circuit
10. Explain why time-delay fuses are used with motor starting circuits
11. Describe three important factors to consider with over current protection devices
12. Describe the operation of a three-phase motor
13. Describe the operating data on a motor's nameplate
14. Define service factor and explain its importance
15. Explain why dual-voltage motors should be run on the highest available voltage

LEARNING ACTIVITIES:

1. Perform a lockout/tag out & use a voltmeter to verify supply voltage
3. Use a digital multi-meter to check the condition of a fuse
4. Connect a dual-voltage three-phase motor for low & high voltage operation
6. READ: Electrical Motor Controls, Electrical Symbols & Diagram pages 77-90 (3rd Ed.)
7. Complete review questions page 90
8. Review Electrical Symbols; Page (516-519)
9. Receive: Wiring Diagram Book, by Square-D

CHECK-OUT ACTIVITIES:

⇒ Given questions, written and/or oral the student must answer questions with 90% accuracy.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Manual Motor Controls

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor at any time you need assistance.

OBJECTIVE:

1. Describe five functions of motor control
2. Describe the four basic requirements of a typical motor installation
3. Define motor controller and motor starter
4. Describe the functions of two categories of motor starters
5. Describe the functions of two types of manual starters
6. Describe the operation of a manual motor starter
7. Define low-voltage protection and describe its importance
8. Describe how low-voltage protection is accomplished in a manual starter
9. Describe the function of three types of overloads and give an application of each
10. Describe the operation of two types of thermal overloads
11. Describe the operation of a magnetic overload

LEARNING ACTIVITIES:

1. Connect and operate a simple motor control circuit
2. Start and stop a motor using a manual starter
3. Set the trip level of a bimetallic overload
4. Select the correct heaters for a NEMA overload

CHECK-OUT ACTIVITIES:

⇒ Given questions, written and/or oral the student must answer questions with 90% accuracy.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Control Transformers

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor at any time you need assistance.

OBJECTIVE:

1. Describe the operation of a transformer and give its schematic symbol
2. Define turns ratio and describe how it is calculated
3. Describe how the turn's ratio determines the secondary voltage of a transformer
4. Describe the function of the four basic components of an electrical control circuit
5. Describe the function of an electrical schematic diagram
6. Describe the function of a control transformer
7. Describe the operation of a control transformer and give its schematic symbol
8. Describe how to test a transformer
9. Describe how to size a transformer
10. Describe the operation of a separate control circuit

LEARNING ACTIVITIES:

1. Calculate the turn's ratio of a transformer
2. Calculate the secondary voltage of a transformer
3. Connect and operate a control transformer
4. Connect and operate a control transformer
5. Size a control transformer

CHECK-OUT ACTIVITIES:

⇒ Given questions, written and/or oral the student must answer questions with 90% accuracy.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Control Ladder Logic

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor at any time you need assistance.

OBJECTIVE:

1. Describe the function of three types of electrical control systems and give an application of each
2. Describe the three steps of a control process
3. Describe the function of an indicator lamp and give an application
4. Describe the operation of a pushbutton switch and give its schematic symbol
5. Describe the operation of a selector switch and give its schematic symbol
6. Describe the function of a ladder diagram
7. Describe the function of four components of a ladder diagram
8. Describe six rules of drawing a ladder diagram
9. Describe how to determine the operation of a circuit given a ladder diagram
10. List six elements of control logic
11. Describe the operation of AND, OR, NOT, NOR, & NAND logic and give an application.

LEARNING ACTIVITIES:

1. Connect and operate a basic electrical control circuit which uses a pushbutton switch
2. Connect and operate a basic electric control circuit using a selector switch
3. Draw a ladder diagram of a control circuit
4. Determine the operation of a control circuit given a ladder diagram
5. Connect and operate a control circuit given a ladder diagram
6. Connect and operate an AND, OR, NOT, NOR, and NAND logic circuit
7. Design a multiple start/stop pushbutton station control circuit
8. Read: Electrical Motor Control, (3rd Ed) Pages 91-108
9. Complete Review Questions Pg 108.

CHECK-OUT ACTIVITIES:

⇒ Given questions, written and/or oral the student must answer questions with 90% accuracy.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Control Relays & Motor Starters

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor at any time you need assistance.

OBJECTIVE:

1. Describe the function of a control relay and give an application
2. Describe the operation of a control relay and give its schematic symbol
3. Describe the operation of two types of control relays and give an application of each
4. Describe how detached symbology is used to show a control relay on a ladder diagram
5. Describe the operation of memory logic and give an application
6. Describe the operation of a magnetic motor starter
7. Describe the operation of a two-wire motor control circuit and give an application
8. Describe the operation of a three-wire motor control circuit and give an application
9. Describe the function of a push-to-test pilot light and give an application
10. Describe the operation of a push-to-test pilot light and give its schematic symbol

LEARNING ACTIVITIES:

1. Connect and operate a control relay in a circuit
2. Connect and operate a memory logic circuit
3. Connect and operate a magnetic motor starter connected to a three-phase motor
4. Connect and operate a two-wire motor control circuit
5. Connect and operate a three-wire motor control circuit
6. Design a multiple operator station three-wire control circuit
7. Connect and operate a three-wire control circuit with a push-to-test pilot light

CHECK-OUT ACTIVITIES:

⇒ Given questions, written and/or oral the student must answer questions with 90% accuracy.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Introduction to Trouble-Shooting

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor at any time you need assistance.

OBJECTIVE:

1. Describe two levels of troubleshooting and give an application of each
2. Describe the three methods of testing a component and give an application of each
3. Describe how to test an indicator lamp
4. Describe how to test a manual switch
5. Describe how to test a control relay
6. Describe how to test a motor contactor
7. Describe how to test an overload relay
8. Describe how to test the windings of a 3-phase motor with a digital multi-meter

LEARNING ACTIVITIES:

1. Test an indicator lamp, manual switch, control Relay, motor contactor, and overload relay.
2. Test the windings of a 3-phase motor with a digital multi-meter
3. Test the windings of a control transformer with a digital multi-meter
4. Read: Electric Control for Machines, by Rexford, Chapter 15, pages 261-279
5. Turn in review questions page 279 (1-14)

CHECK-OUT ACTIVITIES:

⇒ Given questions, written and/or oral the student must answer questions with 90% accuracy.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Systems Trouble-Shooting

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor at any time you need assistance.

OBJECTIVE:

1. Describe the function of four common electrical test instruments used in troubleshooting
2. Describe how to select a DMM to measure voltage for a given application
3. Describe how to use a voltage tester (wiggy)
4. Describe how to use a clamp-on ammeter
5. Describe how to use a continuity tester
6. Describe a six step troubleshooting sequence
7. Describe four methods of systems level troubleshooting and give an advantage of each
8. Describe five types of in-circuit component tests
9. Describe how to test and analyze circuit signals

LEARNING ACTIVITIES:

1. Select and use a DMM to measure voltage, use a voltage tester (wiggy), use a clamp-on ammeter for a given application, & and use a continuity tester for a given application
2. Perform and analyze circuit signal tests
3. Use the symptom and cause troubleshooting method to isolate a bad component
4. Use the output-back troubleshooting method to isolate a bad component
5. Use the half-split troubleshooting method to isolate a bad component
6. Use the shotgun troubleshooting method to isolate a bad component
7. Troubleshoot a 2-wire control system & three-wire control system
8. Read: Electric Motor Controls, (3rd Ed.) Pages 31-52, & Pages (551-581)

CHECK-OUT ACTIVITIES:

⇒ Given questions, written and/or oral the student must answer questions with 90% accuracy.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Automatic Input Devices

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor at any time you need assistance.

OBJECTIVE:

1. Describe the functions of four types of automatic input devices and give an application of each
2. Describe the operation of a limit switch and give its schematic symbol
3. Describe the operation of a float switch and give its schematic symbol
4. Describe the operation of a pump control circuit
5. Describe the operation of a pressure switch and give its schematic symbol
6. Describe how to test an automatic input switch
7. Describe the function of a sequence control circuit and give an application
8. Describe the operation of a sequence control

LEARNING ACTIVITIES:

1. Connect and operate a limit switch
2. Design an overhead door motor control circuit
3. Connect and operate a float switch
4. Connect and operate a pump control circuit
5. Connect and operate a pressure switch
6. Design a pump control circuit that includes H-O-A operation
7. Test an automatic input switch
8. Connect and operate a sequence control circuit
9. Troubleshoot a sequence control circuit
10. Design a sequence control circuit

CHECK-OUT ACTIVITIES:

⇒ Given questions, written and/or oral the student must answer questions with 90% accuracy.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Electronic Sensors

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor at any time you need assistance.

OBJECTIVE:

1. Describe the function of three types of electronic sensors and give an application of each
2. Describe the operation of an inductive proximity sensor and give its schematic symbol
3. Describe five characteristics that affect inductive sensor operation
4. Describe the operation of a capacitive proximity sensor and give its schematic symbol
5. Describe five characteristics that affect capacitive sensor operation
6. Describe the operation of a photoelectric sensor and give an application
7. Describe five characteristics that affect photoelectric sensor performance

LEARNING ACTIVITIES:

1. Connect and operate an inductive proximity sensor
2. Measure and analyze inductive proximity sensor performance
3. Design a drill motor control circuit which uses an inductive proximity sensor
4. Connect and operate a capacitive proximity sensor
5. Measure and analyze capacitive proximity sensor performance
6. Design a level sensing control circuit which uses a capacitive proximity sensor
7. Connect and operate a photoelectric sensor
8. Connect and operate a motor control circuit with a photoelectric sensor
9. Troubleshoot a motor control circuit with an electronic sensor
10. Design a motor control circuit that will sense product jams on a conveyor system

CHECK-OUT ACTIVITIES:

⇒ Given questions, written and/or oral the student must answer questions with 90% accuracy.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Timers and Counters

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor at any time you need assistance.

OBJECTIVE:

1. Describe the operation of a one-shot timer and give an application
2. Describe the operation of a repeat cycle timer and give an application
3. Describe the function of two types of counters and give an application of each
4. Describe the operation of an up counter and give its ladder diagram symbol
5. Describe the operation of a down counter and give its ladder diagram symbol

LEARNING ACTIVITIES:

1. Connect and operate a timed one-shot time delay relay
2. Troubleshoot a timed one-shot motor control circuit
3. Design a timed one-shot motor control circuit
4. Connect and operate a repeat cycle time-delay relay
5. Troubleshoot a timed repeat cycle motor control circuit
6. Design a timed repeat cycle motor control circuit
7. Connect and operate a down counter
8. Design a motor control circuit using a counter to count operations

CHECK-OUT ACTIVITIES:

⇒ Given questions, written and/or oral the student must answer questions with 90% accuracy.
⇒ **A COMPREHENSIVE LAB FINAL**

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: DC Series Motors

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor at any time you need assistance.

OBJECTIVE:

1. Describe the function of an electric motor
2. List the three basic components of an electric motor and describe their function
3. List five advantages and four disadvantages of driving a machine with an electric Motor
4. List three categories of electric motors and give an advantage of each
5. List and describe five rules of safe dress around electric motors
6. List and describe nine basic rules of electric motor operation safety
7. List the five components of a DC motor and describe their function
8. Describe the operation of a DC motor
9. List three wiring configurations for a DC motor
10. Describe how a DC motor is wired for series operation
11. List an advantage and a disadvantage of a DC series motor
12. List three applications of a DC series motor
13. Describe how to change the direction of rotation of a DC motor

LEARNING ACTIVITIES:

1. Electric motor application video
2. Motor safety video
3. Connect and operate a DC series motor
4. Reverse the rotation of a DC series motor

CHECK-OUT ACTIVITIES:

⇒ Given questions, written and/or oral the student must answer questions with 90% accuracy.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: DC Shunt and Compound Motors

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor at any time you need assistance.

OBJECTIVE:

1. Describe how a DC motor is wired for self-excited shunt operation
2. List an advantage and a disadvantage of a self-excited DC shunt motor
3. Describe how a DC motor is wired for separately-excited shunt operation
4. List an advantage and a disadvantage of a separately-excited DC shunt motor
5. List two applications of a self-excited and a separately-excited DC shunt motor
6. Describe how a DC motor is wired for compound operation
7. List an advantage and a disadvantage of a DC compound motor
8. Describe the types of DC compound motor configurations
9. List three applications of a DC compound motor

LEARNING ACTIVITIES:

1. Connect and operate a self-excited DC shunt motor
2. Connect and operate a separately-excited DC shunt motor
3. Reverse the rotation of a DC shunt motor
4. Connect and operate a cumulative DC compound motor
5. Reverse the rotation of a DC compound motor

CHECK-OUT ACTIVITIES:

⇒ Given questions, written and/or oral the student must answer questions with 90% accuracy.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Motor Speed and Torque

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor at any time you need assistance.

OBJECTIVE:

1. List and describe two methods used to measure motor speed
2. List two applications for measuring motor speed
3. Define torque and explain how it is calculated
4. Describe how motor torque is developed
5. Define motor load and explain its effect on motor operation
6. Describe how to calculate the load on an electric motor with a gear or belt drive
7. Describe the effect a belt or gear drive has on speed
8. List and describe three methods to determine the torque delivered by a motor
9. Give an application for measuring torque

LEARNING ACTIVITIES:

1. Measure the speed of a motor using a hand-held mechanical tachometer
2. Measure the speed of a motor using a strobe-light tachometer
3. Calculate torque given force and distance
4. Calculate the load on a motor that uses a gear drive or belt drive system
5. Calculate the speed of a load that is driven with a belt drive or gear system
6. Measure the torque delivered by a motor using a prony brake
7. Determine the torque delivered by a motor using current measurements

CHECK-OUT ACTIVITIES:

⇒ Given questions, written and/or oral the student must answer questions with 90% accuracy.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Motor Performance

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor at any time you need assistance.

OBJECTIVE:

1. Define motor power and explain its importance
2. Define motor efficiency and explain its importance
3. List four performance characteristics of a motor and explain their importance
4. Describe the speed/torque characteristics of three DC motor configurations

LEARNING ACTIVITIES:

1. Calculate the power of a motor, given speed and torque
2. Covert between English and S.I. units of motor power
3. Calculate the efficiency of a motor given input and output power
4. Measure and calculate the performance characteristics of a DC motor
5. Plot and analyze the torque vs. speed curve of a DC motor
6. Plot and analyze the efficiency vs. power curve of a DC motor
7. Select the correct DC motor for an application based on motor performance characteristics

CHECK-OUT ACTIVITIES:

⇒ Given questions, written and/or oral the student must answer questions with 90% accuracy.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Split Phase Motors

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor at any time you need assistance.

OBJECTIVE:

1. Describe the waveform produced by alternating current
2. Define AC frequency and give its units of measurement
3. List and describe two methods of representing AC voltage
4. Describe the operation of multiphase AC electricity and explain how it is used
5. List the two categories of AC motors and give an advantage of each
6. List four types of single-phase AC motors
7. Describe the operation of a split-phase motor
8. List an advantage and a disadvantage of a split-phase motor
9. Describe how to calculate AC motor synchronous speed and explain its importance
10. Describe two methods used to determine the actual speed of an AC motor
11. List three applications of a split-phase AC motor
12. Describe how to reverse the rotation direction on a single-phase AC motor

LEARNING ACTIVITIES:

1. Convert between the effective value of AC voltage and the peak voltage
2. Connect and operate a split-phase motor
3. Calculate AC motor synchronous speed given the frequency and the number of poles
4. Measure and graph split-phase motor performance characteristics
5. Reverse the rotation of a split-phase motor

CHECK-OUT ACTIVITIES:

⇒ Given questions, written and/or oral the student must answer questions with 90% accuracy.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Capacitor Start Motors

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor at any time you need assistance.

OBJECTIVE:

1. Define apparent power and explain its importance
2. Define power factor and explain its importance
3. List and describe two applications for capacitors in AC circuits
4. Describe the operation of a capacitor-start motor
5. List an advantage and a disadvantage of a capacitor-start motor
6. List three applications of a capacitor-start motor
7. Describe the purpose of a bleeder resistor
8. Describe how to determine the resistance value of a resistor using color codes

LEARNING ACTIVITIES:

1. Calculate apparent power given input voltage and current
2. Calculate the power factor given the active power and apparent power
3. Calculate the cost of operating an electric motor
4. Correct the power factor by calculating the correction capacitor value
5. Connect and operate a capacitor-start motor
6. Measure and graph capacitor-start motor performance characteristics
7. Reverse the rotation of a capacitor-start motor

CHECK-OUT ACTIVITIES:

⇒ Given questions, written and/or oral the student must answer questions with 90% accuracy.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Permanent Capacitor Motors

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor at any time you need assistance.

OBJECTIVE:

1. Describe the operation of a permanent-capacitor motor
2. List four advantages and a disadvantage of a permanent-capacitor motor
3. List three applications of a permanent-capacitor motor
4. Describe how the speed of a permanent-capacitor motor is controlled and give an application
5. Describe the operation of a capacitor-start capacitor-run motor
6. List an advantage and a disadvantage of a capacitor-start capacitor-run motor
7. List three applications of a capacitor-start capacitor-run motor

LEARNING ACTIVITIES:

1. Connect and operate a permanent-capacitor motor
2. Measure and graph permanent-capacitor motor performance characteristics
3. Reverse the rotation of a permanent-capacitor motor
4. Permanent-capacitor motor multi-speed operation
5. Connect and operate a capacitor-start capacitor-run motor
6. Measure and graph capacitor-start capacitor-run motor performance characteristics
7. Reverse the rotation of a capacitor-start capacitor-run motor

CHECK-OUT ACTIVITIES:

⇒ Given questions, written and/or oral the student must answer questions with 90% accuracy.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Three Phase Motors

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor at any time you need assistance.

OBJECTIVE:

1. List two categories of three-phase AC motors
2. List two types of induction motors
3. Describe the construction and operation of a squirrel-cage induction motor
4. List five advantages and two disadvantages of a three-phase induction motor
5. List three applications of a three-phase induction motor
6. List and describe the operation of two three-phase power distribution configurations
7. Describe how to connect a single-voltage three-phase motor
8. Describe how to connect a dual-voltage wye motor for low or high voltage
9. Describe how to connect a dual-voltage delta motor for low or high voltage
10. Describe how to reverse the rotation direction of a three-phase induction motor

LEARNING ACTIVITIES:

1. Connect and operate a three-phase induction motor
2. Measure and graph induction motor performance characteristics
3. Wye distribution system characteristics
4. Determine how to connect a three-phase motor to operate on the available voltage
5. Reverse the rotation of a three-phase induction motor

CHECK-OUT ACTIVITIES:

⇒ Given questions, written and/or oral the student must answer questions with 90% accuracy.

PROGRAM: Industrial Electricity/Electronics

TASK: Power Generation and Distribution

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor at any time you need assistance.

OBJECTIVE:

1. Describe the operation of two methods of AC power generation
2. Describe how multi-phase AC power is produced
3. Describe four types of AC power plants
4. Describe the operation of a three-phase wye distribution system and give an application
5. Describe an advantage and a disadvantage of a three-phase wye distribution system
6. Describe the operation of a three-phase delta distribution system and give an application
7. Describe an advantage and a disadvantage of a three-phase delta distribution system
8. Describe how to use transformers to form distribution banks and give an application

LEARNING ACTIVITIES:

1. Use a multi-meter to determine whether a distribution system is a wye or a delta configuration
2. Connect and operate single-phase transformers in a wye-to-wye bank configuration
3. Connect and operate single-phase transformers in a delta-to-delta bank configuration
4. Connect and operate single-phase transformers in a wye-to-delta bank configuration
5. Answer all review questions and show instructor your work

CHECK-OUT ACTIVITIES:

⇒ Given questions, written and/or oral the student must answer questions with 90% accuracy.
⇒ Show 100% proficiency in LAB WORK

PROGRAM: Industrial Electricity/Electronics

TASK: Electrical Wiring Techniques

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor at any time you need assistance.

OBJECTIVE:

1. Describe the two methods of stating electrical wire size
2. Describe two methods of measuring the size of a wire
3. Describe the function of the National Electrical Code
4. Describe two factors to consider when sizing wire for an application
5. Describe the operation of three tools used to strip wire
6. Describe the function and construction of two types of wiring terminals
7. Describe two methods to connect wires to terminal screws
8. Describe the function of a 3-wire AC circuit
9. Describe the function of a ground in a 3-wire circuit
10. Describe the function of an AC electrical plug

LEARNING ACTIVITIES:

1. Calculate line drop
2. Size wire for an application
3. Strip insulation from wires using a stripping tool
4. Build a 12 foot AC electrical cord
5. Answer all review questions and show instructor your work

CHECK-OUT ACTIVITIES:

⇒ Given questions, written and/or oral the student must answer questions with 90% accuracy.
⇒ Show 100% proficiency in LAB WORK

PROGRAM: Industrial Electricity/Electronics

TASK: Wiring System Installation

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor at any time you need assistance.

OBJECTIVE:

1. Describe the construction and application of three accepted wiring systems
2. Describe the function of an installation plan
3. Describe the three factors that determine the number of wires that can be installed in conduit
4. Describe the function of a fish tape
5. Describe the function and operation of a 3-way switch
6. Describe the function of an electrical outlet
7. Describe two common methods for splicing wires
8. List two common lighting systems and give an application for each
9. Describe the function of a service entrance

LEARNING ACTIVITIES:

1. Read and interpret a wiring installation plan
2. Pull wire through stud wall construction
3. Draw and install a switch, a 3-way switch, and a duplex outlet
4. Properly splice wires
5. Install an incandescent light fixture
6. Install a circuit breaker
7. Troubleshoot a wiring installation
8. Connect the wiring system to the service
9. Answer all review questions and show instructor your work

CHECK-OUT ACTIVITIES:

⇒ Given questions, written and/or oral the student must answer questions with 90% accuracy.
⇒ Show 100% proficiency in LAB WORK

PROGRAM: Industrial Electricity/Electronics

TASK: Introduction to Raceways

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor at any time you need assistance.

OBJECTIVE:

1. Describe the function of a wiring system
2. Describe the function of the four basic parts of a wiring system
3. Describe the function of conduit and list five types
4. Describe three methods by which conduit is cut
5. Describe the construction and operation of a hacksaw
6. Describe the function of a pipe vise and give three types
7. Describe the construction and operation of a bench vise with pipe jaws
8. Describe six safety rules to follow when operating the bench vise
9. Describe the function of de-burring conduit and give four tools that can be used
10. Describe the function of an electrical box and give an application
11. Describe the function of a conduit body and give an application
12. Describe the function of a conduit fitting
13. Describe the function and operation of three types of connectors
14. Describe the function of a coupling
15. Describe the function of a conduit strap and list three types

LEARNING ACTIVITIES:

1. Change a blade on a hacksaw
2. Use a bench vise to hold conduit
3. Cut EMT conduit to length using a hacksaw
4. De-burr conduit
5. Thread two ends of ½ inch rigid conduit
6. Answer all review questions and show instructor your work

CHECK-OUT ACTIVITIES:

⇒ Given questions, written and/or oral the student must answer questions with 90% accuracy.
⇒ Show 100% proficiency in LAB WORK

PROGRAM: Industrial Electricity/Electronics

TASK: Basic Conduit Bending

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor at any time you need assistance.

OBJECTIVE:

1. Describe the function of conduit bending and list three basic types of bends
2. Describe the function of a conduit bender and two methods that are used to bend conduit
3. Describe four types of benders used with metallic conduit
4. Describe the construction and operation of a hand bender
5. Define the components of a 90° bend
6. Describe bender take-up and its importance in making a 90° bend
7. Describe the five steps used to determine bender take up
8. Describe the five steps to lay out accurate leg lengths and stub lengths
9. Describe the components of an offset bend
10. Describe the four steps used to determine and locate the bend centers of an offset bend

LEARNING ACTIVITIES:

1. Determine the take-up of a hand bender
2. Bend a 90 degree stub in EMT conduit
3. Bend a three inch offset in EMT conduit
4. Bend a pipe saddle in EMT conduit
5. Bend a box offset in EMT conduit
6. Bend a standard saddle
7. Answer all review questions and show instructor your work

CHECK-OUT ACTIVITIES:

⇒ Given questions, written and/or oral the student must answer questions with 90% accuracy.
⇒ Show 100% proficiency in LAB WORK

PROGRAM: Industrial Electricity/Electronics

TASK: Advanced Raceways

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor at any time you need assistance.

OBJECTIVE:

1. Describe the similarities and differences between intermediate metallic and rigid conduit
2. Describe three tools used to cut intermediate metallic and rigid conduit
3. Describe two tools used to bend IMC and rigid conduit
4. Describe the construction and operation of a mechanical bender
5. Describe the method used to thread IMC and rigid conduit
6. Describe the connectors and couplings used with IMC and rigid conduit
7. Describe how flexible metal conduit is cut
8. Describe the connectors used with flexible metal conduit

LEARNING ACTIVITIES:

1. Cut intermediate metallic conduit
2. Bend IMC with a mechanical bender
3. Connect and couple IMC given an application
4. Make a complete conduit run
5. Answer all review questions and show instructor your work

CHECK-OUT ACTIVITIES:

⇒ Given questions, written and/or oral the student must answer questions with 90% accuracy.
⇒ Show 100% proficiency in LAB WORK

PROGRAM: Industrial Electricity/Electronics

TASK: Conductors Disconnects and Over Current Protection

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor at any time you need assistance.

OBJECTIVE:

1. Describe the function of a conductor and list its two components
2. Describe the factors that affect conductor selection
3. Describe five common classifications of insulation and give an application of each
4. Define conductor ampacity and describe the physical characteristics that affect it
5. Describe how distance affects wire selection
6. Describe the function of a disconnect and give an application
7. Describe three commonly used types of disconnects and give an application of each
8. Describe how to size a disconnect
9. Describe the function of over-current protection and list two types
10. Describe how to size circuit protection

LEARNING ACTIVITIES:

1. Select wire size and type for an application
2. Select a disconnect for an application
3. Select circuit protection for an application
4. Answer all review questions and show instructor your work

CHECK-OUT ACTIVITIES:

⇒ Given questions, written and/or oral the student must answer questions with 90% accuracy.
⇒ Show 100% proficiency in LAB WORK

WBEL-8G

PROGRAM: Industrial Electricity/Electronics

TASK: Conduit Sizing and Wire Pulling Techniques

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor at any time you need assistance.

OBJECTIVE:

1. Describe percentage of fill and its importance in raceway selection
2. Describe two methods used to select raceway diameter
3. Describe the 7 steps used to determine conduit size when conductors are of different size and/or types
4. Describe why electrical codes limit the number of conductors in an electrical box
5. Describe how to select the correct size electrical box
6. Describe how conduit bodies are selected
7. Describe three methods used to pull conductors
8. Describe the function of a bus bar and give an application
9. Describe the function of a bus plug

LEARNING ACTIVITIES:

1. Use NEC tables to select the proper size raceway for same size/type conductors
2. Determine conduit size when conductors are of different size and/or types
3. Determine electrical box size when conductors are the same size
4. Determine electrical box size when conductors are of different sizes
5. Pull conductors using fish tape
6. Connect a bus plug to a bus bar
7. Design and install a wiring system given specifications
8. Answer all review questions and show instructor your work

CHECK-OUT ACTIVITIES:

⇒ Given questions, written and/or oral the student must answer questions with 90% accuracy.
⇒ Show 100% proficiency in LAB WORK

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Plans and Sitework

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See the Instructor any time you need assistance.

OBJECTIVE: After completing this module you will be able to:

* Read Site Plans
* Select Materials for Site Work
* Identify Underground Wiring Methods

LEARNING ACTIVITIES:

1) READ: Electrical Wiring-Industrial, by Smith and Herman, 10th Edition,
   Unit 1, "Plans and Sitework", pages 1-9
   "Electrical Specifications", pages 231-238

2) CHECK: yourself by completing the Review Questions in Electrical Wiring Industrial, for Unit 1.

3) STUDY: the ***drawings*** from the back of Electrical Wiring-Industrial

4) ARRANGE: to complete this module by going through the **Check-Out Activities**.

CHECK-OUT ACTIVITIES:

⇒ The student will complete and turn-in *Review Questions* for Unit 1 in Electrical Wiring Industrial.

⇒ Given questions on plans and site work, the student will answer with 90% accuracy.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Industrial Power Systems

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See the Instructor at any time you need assistance.

OBJECTIVE: After completing this module you will become familiar with:

* Unit Substations
* Feeder and Trolley Bus Systems
* Panelboards

LEARNING ACTIVITIES:

1) READ: Electrical Wiring Industrial, by Smith and Herman, 10th Edition,
   Unit 2, "The Unit Substation", pages 10-22
   Unit 3, "Feeder Bus System", pages 23-32
   Unit 4, "Panelboards", pages 33-39
   Unit 5, "Trolley Busways", pages 40-52

2) CHECK: yourself by completing the *Review Questions* in Electrical Wiring Industrial for Units 2, 3, 4, & 5.

3) READ: Electrical Motor Controls, *Second Edition*, by Rockis & Mazur, pages 247-269, "Power Distribution Systems"

4) COMPLETE: the *Review Questions*, on page 270, in Electrical Motor Controls, *Second Edition*

5) ARRANGE: to complete this module by completing the **Check-Out Activities**.

CHECK-OUT ACTIVITIES:

⇒ The student will complete and turn-in *Review Questions* from Units 2, 3, 4, & 5 in Electrical Wiring Industrial.

⇒ Given questions on industrial power systems the student will answer with 90% accuracy.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Signaling Systems

DIRECTIONS: Read the Objective and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See the Instructor at any time you need assistance.

OBJECTIVE: After completing this module you will understand the installation and operation of the following:

* Master Clock
* Program System
* Paging System
* Fire Alarm System

LEARNING ACTIVITIES:

1) READ: Electrical Wiring Industrial, by Smith and Herman, 10th Edition, Unit 7, "Signaling Systems", pages 70-80

2) CHECK: yourself by completing the Review Questions in Electrical Wiring Industrial, for Unit 7.

3) COMPLETE: **Lab Exercises**, see Instructor for Lab Manual

4) ARRANGE: to complete this module by completing the **Check-Out Activities.**

CHECK-OUT ACTIVITIES:

⇒ The student will complete and turn-in *Review Questions* from Unit 7, in Electrical Wiring Industrial.

⇒ Given questions on signaling systems the student will answer with 90% accuracy.

⇒ The student will complete **Lab Exercises** to the Instructors satisfaction.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Motors, Controllers, and Installations

DIRECTIONS: Read the Objective and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See the Instructor at any time you need assistance.

OBJECTIVE: After completing this module the student will be able to:

* Describe machine layout, types of equipment, and branch circuits.
* Calculate for complete motor installations.

LEARNING ACTIVITIES:

1) READ: Electrical Wiring Industrial, by Smith and Herman, 10th Edition,
   Unit 8, "Motors and Controllers", pages 81-111
   Unit 9, "Motor Installation", pages 112-124

2) READ & USE: 1999 NEC while completing this module

3) CHECK: yourself by completing the Review Questions in Electrical Wiring Industrial, for Unit 8 and Unit 9

4) ARRANGE: to complete this module by completing the **Check-Out Activities.**

CHECK-OUT ACTIVITIES:

⇒ The student will complete and turn-in *Review Questions* from Units 8 & 9 in Electrical Wiring Industrial.
⇒ Complete **Lab Exercise** (wiring complete motor control system on Amatrol Trainer)
⇒ Given questions on motors, controllers, and installations, the student will answer with 90% accuracy.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Special Equipment and H.V.A.C.

DIRECTIONS: Read the Objective and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See the Instructor at any time you need assistance.

OBJECTIVE: After completing this module the student will be able to:

* Understand the purpose and operation of precipitators.
* Understand the fundamentals of power factor correction, and the equipment used.
* Explain the fundamentals of HVAC.

LEARNING ACTIVITIES:

1) READ: Electrical Wiring Industrial, by Smith and Herman, 10th Edition,
   Unit 10, "Special Equipment", pages 125-141
   Unit 11, "Ventilating, Air Conditioning, & Other Facilities", pages 142-149

2) CHECK: yourself by completing the Review Questions in Electrical Wiring Industrial, for Units 10 and 11

3) ARRANGE: to complete this module by going through the **Check-Out Activities**.

CHECK-OUT ACTIVITIES:

⇒ The student will complete and turn-in *Review Questions* from Units 10 & 11, in Electrical Wiring Industrial.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Hazardous Locations

DIRECTIONS: Read the Objective and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See the Instructor at any time you need assistance.

OBJECTIVE: After completing this module the student will be able to:

* Discuss different classes, divisions, and groups of hazardous locations.
* Describe intrinsically safe circuits.
* Be familiar with hazardous installations and equipment.

LEARNING ACTIVITIES:

1) READ: Electrical Wiring Industrial, by Smith and Herman, 10th Edition, Unit 16, "Hazardous Locations", pages 199-221

2) READ & USE: 2002 NEC while completing this module.

3) VIEW: "Electrical Connection in Hazardous Locations" by Appleton Electrical. (INEL-4J)

4) CHECK: yourself by completing the Review Questions in Electrical Wiring Industrial, for Unit 16.

5) ARRANGE: to complete this module by going through the **Check-Out Activities**

CHECK-OUT ACTIVITIES:

⇒ Student will complete and turn-in *Review Questions* from Unit 16, in Electrical Wiring Industrial.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Single Phase Transformers

DIRECTIONS: Read the Objective and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See the Instructor at any time you need assistance

OBJECTIVE: After completing this module the student will be able to:

* Explain why and how transformers are used for power distribution.
* Describe basic construction.
* Explain primary and secondary relationships.
* Diagram the connections for single-phase transformers.

LEARNING ACTIVITIES:

1) READ: Standard Textbook of Electricty, Third Edition, by S. Herman, Unit 27 pages 711-756, "Single Phase Transformers"

2) CHECK: yourself by completing the *Review Questions* for Unit 27, pages 756-757 in the Standard Textbook of Electricity.

3) COMPLETE: The Practice Problems on pages 758-759, in the Standard Textbook of Electricity.

4) ARRANGE: to complete this module by going through the **Check-Out Activities.**

CHECK-OUT ACTIVITIES:

⇒ The student will complete and turn-in the *Review Questions* from Unit 27 in Standard Textbook of Electricity.

⇒ Given questions on single-phase transformers, the student will answer with 90% accuracy.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Three-Phase Transformers

DIRECTIONS: Read the Objective and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See the Instructor at any time you need assistance

OBJECTIVE: After completing this module the student will be able to:

* Explain and draw diagrams showing how single phase transformers can be connected for three-phase.
* Identify three-phase connections.
* Understand KVA capacity.
* Describe set-up and step-down applications.
* Use and install instrument transformers.

LEARNING ACTIVITIES:

1) READ: Standard Textbook of Electricity, Third Edition, by S. Herman, Unit 28, pages 760-801 "Three Phase Transformers"

2) COMPLETE: the *Review Questions*, in the Standard Textbook of Electricity, Unit 28

3) COMPLETE: **Lab Exercises**, in Distribution Transformer Trainer manual

4) ARRANGE: to complete this module by completing the **Check-Out Activities.**

CHECK-OUT ACTIVITIES:

⇒ The student will complete and turn-in *Review Questions* from Standard Textbook of Electricity, Unit 28

⇒ Complete **Lab Exercises** to the satisfaction of the Instructor.

⇒ Given questions on Three-phase transformer systems, the student will answer with 90% accuracy.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Transformer NEC Requirements

DIRECTIONS: Read the Objective and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See the Instructor at any time you need assistance

OBJECTIVE: In this module you will become familiar with NEC requirements for transformers.

LEARNING ACTIVITIES:

1) READ: Article 450, of the 1999 NEC, (check the NEC Handbook)

2) READ: **Hand-Out,** "For NEC Transformer Requirements".

3) CHECK: yourself by completing the Achievement Review for Unit 24.

4) ARRANGE: to complete this module by completing the **Check-Out Activities.**

CHECK-OUT ACTIVITIES:

⇒ See your instructor for check-out activities.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Plant Emergency Electrical Systems

DIRECTIONS: Read the Objective and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See the Instructor at any time you need assistance

OBJECTIVE: In this module you will become familiar with emergency electrical systems.

LEARNING ACTIVITIES:

1) RECEIVE AND READ: **HAND-OUT** "Plant Emergency Electrical Systems".

2) READ: Article 700, of the 2002 NEC, (check the NEC Handbook)

3) ARRANGE: to complete this module by completing the **Check-Out Activities.**

CHECK-OUT ACTIVITIES:

⇒ Given questions on emergency electrical systems, the student will answer with 90% accuracy.

PROGRAM: Industrial Electricity/Electronics

TASK: Electrical Control Wiring

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor at any time you need assistance.

OBJECTIVE:

1. Describe the function of an electrical print
2. Describe the function of electrical print mnemonics
3. Describe the function of notes on an electrical print
4. Describe how to interpret an electrical print
5. Describe the function of an electrical panel
6. Describe the function of three types of electrical panels
7. Describe the function of electrical terminal blocks
8. Describe how to select a terminal block for an application
9. Describe how to install a terminal block
10. Describe the importance of using wire number labels
11. Describe how to label wire numbers on an electrical print
12. Describe how to determine the number of wires to run between panels
13. Describe the function of wire color coding in electrical control
14. Describe how to determine the wire colors needed in an electrical panel

LEARNING ACTIVITIES:

1. Interpret an electrical print
2. Select terminal blocks for an application
3. Install a terminal block in an electrical panel
4. Label wire numbers on an electrical print
5. Determine the number of wires to run from a control panel to an operator station
6. Determine the wire colors needed for an application

CHECK-OUT ACTIVITIES:

⇒ Given questions, written and/or oral the student must answer questions with 90% accuracy.
⇒ Get Electrical Print and wire relay logic panel to NEC standards.

PROGRAM: Industrial Electricity/Electronics

TASK: Electrical Control Systems

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor at any time you need assistance.

OBJECTIVE:

1. Describe how to terminate panel wires
2. Describe how to install wire number labels on wire
3. Describe two methods used to identify wires which are run between panels
4. Describe how to hand feed wires through conduit
5. Describe how to splice motor wires using ring lug connectors
6. Describe how to tape motor leads
7. Describe the function of panel wire ways
8. Describe how to determine wire lengths inside a panel
9. Describe two methods to connect wires to terminal screws
10. Describe the function of wire bundling
11. Describe three common methods of wire bundling

LEARNING ACTIVITIES:

1. Terminate wires at a terminal block
2. Run wires between panels
3. Splice motor leads using ring lug connectors
4. Connect a wire to a terminal screw
5. Wire an electrical panel
6. Bundle wires in an electrical panel
7. Secure wire bundles in an electrical panel

CHECK-OUT ACTIVITIES:

⇒ Given questions, written and/or oral the student must answer questions with 90% accuracy.
⇒ Get Electrical Print and wire PLC panel to NEC standards.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Using The Oscilloscope

DIRECTIONS: Read the **Objective** and **Check-Out Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor any time you need assistance.

OBJECTIVE: This module will introduce you to the oscilloscope and the basic procedures for operation. The oscilloscope is a test instrument that is widely used more than any other test instrument in the electronics industry.

LEARNING ACTIVITIES:

1) RECEIVE & READ: "The XYZ's of Using a Scope", published by TektronixCorp.
   This is for the student to keep. Answer the questions in this booklet.

2) VIEW: video, "Oscilloscope Primer: Practical Scope Measurements with the 2225"

3) COMPLETE: the **Lab Exercises**, **SEE YOUR INSTRUCTOR**

4) ARRANGE: to complete this module by going through the **Check-Out Activities.**

CHECK-OUT ACTIVITIES:

- Given an oscilloscope, the student will demonstrate his/her understanding of an oscilloscope by:
  a) turning on an oscilloscope properly
  b) connecting an oscilloscope to an audio generator using the lab circuit
  c) adjusting an oscilloscope for a proper waveform
  d) determine the peak to peak voltage of the audio output, convert to peak, & convert to RMS
  e) determine the period of the waveform and convert to frequency
  f) determine the D.C. offset voltage
- Given a written test the student will answer with 80% accuracy.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Meters For Electronics

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See the Instructor any time you need help.

OBJECTIVE: In this module you will learn about these meters and why we need to use them. In working with electronic circuits, it will be necessary to use specialized electronic meters.

LEARNING ACTIVITIES:

1) COMPLETE: the **Lab Exercises**, receive these from your **INSTRUCTOR**.

2) ARRANGE: to complete this module by going through the **Check-Out Activities**.

CHECK-OUT ACTIVITIES:

- Given the proper components and equipment the student will perform laboratory experiments with 100% accuracy.
- Given written questions on electronic meters the student will answer with 80% accuracy.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Electronic Soldering

DIRECTIONS: Read the **Objective** and **Check-Out Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor any time you need assistance.

OBJECTIVE: As an electrician , you must become familiar with electronic soldering. You will be required to use different types of solder and soldering tools. This module will introduce you to the vocabulary and techniques necessary for electronic soldering.

LEARNING ACTIVITIES:

1) READ: Applied Electricity and Electronics, by Bayne,
   "Electrical Soldering", Chapter 11, pages 201-224
   "Assembly and Repair Techniques", Chapter 12, pages 226-253

2) CHECK: yourself by completing the *Questions and Problems*, 1-20, on page 225, and on page 253 in Applied Electricity and Electronics

3) ARRANGE: to complete this module by going through the **Check-Out Activities.**

CHECK-OUT ACTIVITIES:

- The student will complete and turn-in *Questions and Problems* from Applied Electricity and Electronics.

- Given questions on soldering the student will answer with 90% accuracy.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Soldering PC Boards

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor any time you need assistance.

OBJECTIVE: This module will introduce you to the PC board's and how to replace and/or repair them. Printed circuit or PC boards are very common in the electronics industry. They save troubleshooting time because they are very easy to replace. At times replacement boards are not accessible.

LEARNING ACTIVITIES:

1) READ: Applied Electricity and Electronics, by Bayne, Chapter 12, "Assembly and Repair Technology", pages 227-253

2) CHECK: yourself by completing the *Questions and Problems*, 1-14, on page 253, in Applied Electricity and Electronics

3) ARRANGE: to complete this module by going through the **Check-Out Activities.**

CHECK-OUT ACTIVITIES:

- The student will complete and turn-in *Questions and Problems*, 1-14 from Applied Electricity and Electronics.
- Complete **Lab Exercise** for soldering PC boards.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Diodes

DIRECTIONS: Read the **Objective** and **Check-Out Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor any time you need assistance.

OBJECTIVE: In this module you will learn the principles by which they function, how they are constructed, and how to test these devices for proper operation and defects. As an electrician you will be working with solid state devices.

LEARNING ACTIVITIES:

1) READ: Applied Electricity and Electronics, by Bayne, Chapter 31, "Semiconductor Fundamentals", pages 515-526

2) CHECK: yourself by completing the *Questions and Problems*, 1-10, on pages 526 & 527, in Applied Electricity and Electronics

3) READ: Electrical Motor Controls, by Rocki & Mazur, pages 225-237

4) CHECK: yourself by completing the *Review Questions* 1-25, in Electrical Motor Controls

5) RECEIVE: Applied Electricity and Electronics **Lab Manual**

6) ARRANGE: to complete this module by going through the **Check-Out Activities.**

CHECK-OUT ACTIVITIES:

- The student will complete and turn-in *Questions and Problems*, 1-10 from Applied Electricity and Electronics. & *Review Questions* 1-25 in Electrical Motor Control
- Complete **Lab Exercises** for semiconductor diodes:
  Activities 31-1, 31-2, 31-3, 31-4, & 31-5 (in your **Lab Manual**)
- Given questions on semiconductor fundamentals the student will answers with 80% accuracy.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Power Supplies

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See the Instructor any time you need help.

OBJECTIVE: In industry it is common to see a variety of power supplies. Some are designed to change AC to AC, DC to AC and the most common to change AC to DC. In this module you will learn how this is done and how to construct a power supply yourself.

LEARNING ACTIVITES:

1) READ: Applied Electricity and Electronics, by Bayne, Chapter 32, "DC Power Supplies", pages 529-543

2) CHECK: yourself by completing the *Questions and Problems*, 1-12, on page 543, in Applied Electricity and Electronics

3) ARRANGE: to complete this module by going through the **Check-Out Activities**.

CHECK-OUT ACTIVITIES:

- The student will complete and turn-in *Questions and Problems*, on page 543, 1-12 from Applied Electricity and Electronics.
- Complete **Lab Exercises** for "Power Supplies", Activities 32-1, 32-2 and 32-3, in your **Lab Manual**.
- Build a variable voltage power supply (kit).
- Given written question on power supplies, the student will answer all questions with 80% accuracy.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Photo Devices

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See the Instructor any time you need help.

OBJECTIVE: Light sensitive devices are used in industry to convert light energy into electrical energy, electrical energy into light energy and light energy into a variable resistance which is used to control electronic circuits. In this module you will learn about some of these devices and their applications.

LEARNING ACTIVITIES:

1) READ: Applied Electricity and Electronics, by Bayne, Chapter 35, starting with "Light-Emitting Diode (LED)" through to "Opto-Isolator", pages 588-592

2) ARRANGE: to complete this module by going through the **Check-Out Activities.**

CHECK-OUT ACTIVITIES:

- Complete **Lab Exercises** for "Miscellaneous Devices", Activities 35-3 and 35-5 in your **Lab Manual.**

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Solid State Devices

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor at any time you need assistance.

OBJECTIVE: In industry, solid state devices such as transistors are used extensively. In this module you will learn about transistors and other types of semiconductors.

LEARNING ACTIVITIES:

1) READ: Applied Electricity and Electronics, by Bayne,
   Chapter 33, "Transistor Fundamentals", pages 545-559
   Chapter 35, "Miscellaneous Devices", pages 583-588

NOTE: Don't worry about all the Formula's (NO Rocket Science)

2) ARRANGE: to complete this module by going through the **Check-Out Activities**.

CHECK-OUT ACTIVITIES:

- Complete **Lab Exercises** in your **Lab Manual** for:
  "Transistor Fundamentals" - Activities 33-1 and 33-3
  "Miscellaneous Devices" - Activities 35-1, 35-2 and 35-4

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Electronic Timing

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor at any time you need assistance.

OBJECTIVE: Working on electrical equipment you will see many types of timing devices. In this module you will learn about the basic electronic timing devices, and how they function.

LEARNING ACTIVITIES:

1) READ: Applied Electricity and Electronics, by Bayne,
   Chapter 21, "RL Circuits", pages 385-386
   (read the "Objectives" through to "AC & an Inductor")
   Chapter 24, "RC Circuits", pages 425-426
   (read the "Objectives" through to "Series RC Circuit Operation")

2) ARRANGE: to complete this module by going through the **Check-Out Activities**

CHECK-OUT ACTIVITIES:

- Given the proper components and equipment the student will complete **Lab Exercises** about electronic timing with 100% accuracy.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Amplifiers

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor at any time you need assistance.

OBJECTIVE: working on electrical equipment you will see many types of amplifiers. In this module, you will learn how some of these work and their different operating characteristics.

LEARNING ACTIVITIES:

1) READ: Applied Electricity and Electronics, by Bayne, Chapter 34, "Transistor Amplifiers", pages 563-580

2) REVIEW: from the *IMPORTANT TERMS* section on page 580 of Chapter 34, choose any ten (10) terms and write the definition for those ten (10) terms.

3) ARRANGE: to complete this module by going through the **Check-Out Activities**

CHECK-OUT ACTIVITIES:

- Complete and turn-in your ten (10) definitions for the *IMPORTANT TERMS* section on page 580.

- Complete **Lab Exercises** for "Transistor Amplifiers", Activities 34-1, 34-2 and 34-3 in you **Lab Manual.**

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Digital Logic Fundamentals

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor at any time you need assistance.

OBJECTIVE: As an electrician you will be working with and troubleshooting digital logic. In this module you will learn about digital logic and troubleshooting procedures for logic circuitry.

LEARNING ACTIVITIES:

1) READ: Applied Electricity and Electronics, by Bayne, Chapter 37, "Introduction to Digital Electronics", pages 613-626

2) CHECK: yourself by completing the *Questions and Problems*, from Applied Electricity and Electronics, 1-15, on page 627

3) ARRANGE: to complete this module by going through the **Check-Out Activities**.

CHECK-OUT ACTIVITIES:

- The student will complete and turn-in *Questions and Problems*, 1-15 from Applied Electricity and Electronics.
- Given questions on "Digital Logic Fundamentals" the student will answer with 90% accuracy.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Digital Logic Applications

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor at any time you need assistance.

OBJECTIVE: This is a hands-on familiarization with various types of logic circuitry.

LEARNING ACTIVITIES:

1) COMPLETE: **Lab Exercises** given to you by the **Instructor**

2) ARRANGE: to complete this module by going through the **Check-Out Activities**

CHECK-OUT ACTIVITIES:

- Given digi-lab equipment and a list of procedures, the student will complete experiments and answer related questions.
- The student will answer written questions on digital logic applications with 80% accuracy.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Proximity Switching

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor at any time you need assistance.

OBJECTIVE: As an electrician you will be required to service equipment with proximity switches. In this module you will learn what proximity switches are and how they work and where they are used.

LEARNING ACTIVITIES:

1) READ: Electrical Motor Controls, *Second Edition*, by Rockis & Mazur, pages 347-367, "Proximity Switches" to the end of the Chapter

2) CHECK: yourself by completing the *Review Questions* 12-22, on page 368, in Electrical Motor Controls, *Second Edition*

3) ARRANGE: to complete this module by going through the **Check-Out Activities**

CHECK-OUT ACTIVITIES:

- Given written questions on proximity switching the student will answer with 80% accuracy.
- Given the proper components and equipment the student will perform the laboratory experiments with 100% accuracy. Lab Experiment's for INEL-11N and 11P will be completed at the end of **INEL-11P**.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Photoelectric Devices

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor at any time you need assistance.

OBJECTIVE: Photoelectric eyes are used extensively in industry for a number of different tasks, sorting, counting and control f machine operations. In this module you will learn how these various uses throughout industry.

LEARNING ACTIVITIES:

1) READ: Electrical Motor Controls, *Second Edition*, by Rockis & Mazur, pages 337-347, "Photoelectric & Proximity Controls", read up to "Proximity Switches"

2) CHECK: yourself by completing *Review Questions*, 1-11, on page 368, in Electrical Motor Controls, *Second Edition*

3) READ: An Introduction to Sensing Concepts & Technology

4) COMPLETE: **Lab Experiments** as assigned by the **Instructor.**

5) ARRANGE: to complete this module by going through the **Check-Out Activities**

CHECK-OUT ACTIVITIES:

- Given written questions on photo-electric devices the student will answer with 80% accuracy.
- Given the proper components and equipment the student will perform the laboratory experiments with 100% accuracy. (You will do Lab experiments for **INEL-11N** and **INEL-11P**.)

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Fiber Optics Fundamentals

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor at any time you need assistance.

OBJECTIVE: Fiber optic devices are becoming more and more useful in Industrial applications. These units are used with photoelectric eyes and as interface cable for programmable logic controllers. This module is designed as an introduction to the theory and use of fiber optics.

LEARNING ACTIVITIES:

1) READ: **Information Sheet**, "Fiber Optic Fundamentals"

2) READ: Technician's Guide to Fiber Optics, by Sterling,
   Chapter 3, "Fiber-Optics as a Communications Medium: Its Advantages", pages 24-32
   Chapter 5, "The Optical Fiber", pages 44 to 47 (to MODES)
   Chapter 7, "Fiber-Optic Cables", pages 72 to 79 (to BREAKOUT CABLES)
   Chapter 14, "Fiber-Optic Cable Installation & Hardware", pages 199 to 207 (to DISTRIBUTION HARDWARE)

NOTE: This module is not designed to go into great depth on this subject, nor is it designed to spend a lot of time with the complex math involved with extensive study of light waves and fiber optic uses. You will not be tested on complex math. This module is designed to give you a good basic training in fiber optics as required by a person working with them in industry.

3) ARRANGE: to complete this module by going through the **Check-Out Activities**.

CHECK-OUT ACTIVITIES:

- Given written questions on fiber optic fundamentals the student will answer with 80% accuracy.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Fiber Optics - Lab

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor at any time you need assistance.

OBJECTIVE: Fiber optic cables can be connected in various ways to several types of equipment in order to accomplish different interface jobs. This module will give you some hands on experience with fiber optic devices.

LEARNING ACTIVITIES:

1) COMPLETE: **Lab Exercises** as assigned by the **Instructor.**

2) ARRANGE: to complete this module by going through the **Check-Out Activities**

CHECK-OUT ACTIVITIES:

- Given the proper components and equipment the student will perform the laboratory experiments with 100% accuracy.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Introduction to Program Controllers

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor at any time you need assistance.

OBJECTIVE:

1. Describe the function of a programmable logic controller and give an application
2. List six advantages of a PLC
3. Describe the functions of the six basic components of a PLC
4. Name three methods of entering a PLC program and give an advantage of each
5. Describe the basic operation of a PLC
6. Explain why PLCs use ladder diagrams
7. Identify and describe the function of the parts of an SLC-500 discrete address
8. Describe the function and operation of input/output diagrams
9. Describe the operation of XIC and XIO input instructions
10. Describe the operation of an OTE instruction
11. Describe the basic operation of PLC ladder logic

LEARNING ACTIVITIES:

1. Open a processor file using PLC software
2. Download a PLC processor file using PLC programming software
3. Monitor a PLC processor file using PLC programming software
4. Run a PLC processor file using PLC programming software
5. Stop a PLC processor file using PLC programming software

CHECK-OUT ACTIVITIES:

⇒ Given questions, written and/or oral the student must answer questions with 90% accuracy.

PROGRAM: Industrial Electricity/Electronics

TASK TITLE: Basic PLC Programming

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor at any time you need assistance.

OBJECTIVE:

1. List five types of numbering systems and explain their importance to PLCs
2. Describe the operation of the Decimal numbering system and give an application
3. Describe the operation of the Binary numbering system and give an application
4. Describe the SLC 500's memory organization
5. Describe the operation of the SLC 500's Input and Output Data Tables
6. Describe the function of six types of processor files
7. Describe three advantages of PLC software
8. Describe how an input device can reference multiple input instructions
9. Describe how the input device logic affects input instruction logic
10. Describe how a PLC controls multiple outputs at the same time

LEARNING ACTIVITIES:

1. Convert between Decimal and Binary
2. View the status of the SLC 500's Input and Output Data Tables
3. Create a PLC project using PLC software
4. Configure the I/O for a PLC project using PLC software
5. Enter a basic PLC program using PLC software
6. Save a PLC program to disk using PLC software
7. Edit a program using PLC software
8. Generate and print out a ladder logic report using PLC software

CHECK-OUT ACTIVITIES:

⇒ Given questions, written and/or oral the student must answer questions with 90% accuracy.

PROGRAM: Industrial Electricity/Electronics

TASK: PLC Motor Control

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor at any time you need assistance.

OBJECTIVE:

1. Describe two methods by which a PLC output can control a motor
2. Describe how to draw a PLC output diagram for a motor application
3. Describe how input instructions can be controlled by output instructions
4. Describe the function and operation of PLC seal-in logic
5. Describe the function and operation of a program interlock and give an application
6. Describe how a program interlock is used for safety
7. Describe the function of project documentation and give an application

LEARNING ACTIVITIES:

1. Design a PLC program to jog a motor
2. Design a PLC program to control the start/stop of a bi-directional motor
3. Design a PLC program to interlock two motors
4. Design a PLC program that uses a safety interlock to control the operation of a machine
5. View project documentation and use it to operate a PLC program
6. Document a PLC program file

CHECK-OUT ACTIVITIES:

⇒ Given questions, written and/or oral the student must answer questions with 90% accuracy.

PROGRAM: Industrial Electricity/Electronics

TASK: Discrete I/O Interfacing

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor at any time you need assistance.

OBJECTIVE:

1. Describe four features used to select a PLC discrete input module
2. Describe five features used to select a PLC discrete output module
3. Describe the effect of leakage current on AC output module operation
4. Explain how to interface to a discrete electronic sensor with NPN or PNP output
5. Describe how to interface a PLC to a machine controller

LEARNING ACTIVITIES:

1. Connect and test a limit switch to a discrete input module
2. Connect and test the operation of a solenoid valve to a PLC output
3. Connect and test the operation of a motor starter to a PLC
4. Connect and test the operation of an electronic sensor to a PLC input module
5. Connect and test the operation of a PLC input module to a robot output module
6. Connect and test the operation of a PLC discrete output module to a robot input module
7. Develop an interface wiring diagram to interface a PLC to a machine controller

CHECK-OUT ACTIVITIES:

⇒ Given questions, written and/or oral the student must answer questions with 90% accuracy.

PROGRAM: Industrial Electricity/Electronics

TASK: Introduction to PLC Trouble-Shooting

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor at any time you need assistance.

OBJECTIVE:

1. Describe two levels of troubleshooting and give an application of each
2. Describe six types of PLC faults
3. Describe the functions of PLC status and diagnostic indicators
4. Describe the operation of the PLC power supply circuit
5. Describe how to troubleshoot PLC power supply problems
6. Describe how to troubleshoot a PLC DC power supply module
7. Describe how to test PLC discrete input devices
8. Describe the operation of the TEST mode and give an application
9. Describe how to test a PLC discrete input module
10. Describe the Force function and give an application
11. Describe the function of the Force Table and its effect on the PLC's input and output data Tables
12. Describe how to test a PLC discrete output device
13. Describe how to test a PLC discrete output module

LEARNING ACTIVITIES:

1. Use PLC status indicators to determine the status of PLC operation
2. Troubleshoot PLC power supply problems
3. Test a PLC discrete input device
4. Test a discrete input module
5. Use the Force Function to force an input or output
6. Use the Force function to test a PLC discrete output device
7. Test a PLC discrete output module

CHECK-OUT ACTIVITIES:

⇒ Given questions, written and/or oral the student must answer questions with 90% accuracy.

PROGRAM: Industrial Electricity/Electronics

TASK: PLC Systems Trouble-Shooting

DIRECTIONS: Read the **Objective** and complete the **Learning Activities** described below. When you think you understand the information, proceed into the **Check-Out Activities**. See your Instructor at any time you need assistance.

OBJECTIVE:

1. Describe the function of the processor status file and give an application
2. Describe how to troubleshoot a PLC processor which controls local I/O
3. Describe five methods of PLC troubleshooting and give an application of each
4. Describe four types of PLC component tests
5. Describe a six-step PLC troubleshooting sequence
6. Describe the operation of the PLC Search function and give an application
7. Describe the function of a Contact Histogram and give an application

LEARNING ACTIVITIES:

1. View and interpret the processor status file
2. Troubleshoot a processor fault
3. Use a six-step sequence to troubleshoot a PLC system
4. Troubleshoot a PLC-controlled electric motor system
5. Use the PLC Search function to find an instruction
6. Create and view a PLC Contact Histogram

CHECK-OUT ACTIVITIES:

⇒ Given questions, written and/or oral the student must answer questions with 90% accuracy.

JENNIFER M. GRANHOLM
GOVERNOR

STATE OF MICHIGAN
DEPARTMENT OF LABOR & ECONOMIC GROWTH
LANSING

KEITH W. COOLEY
DIRECTOR

MICHIGAN STATE ELECTRICAL ADMINISTRATIVE BOARD
BUREAU OF CONSTRUCTION CODES
2501Woodlake Circle
Okemos, Michigan 48864

Appeal Docket No.
ELEC-07-15

Petitioner, Randal E. Cole

Vs.

Respondent, Michigan Department of Labor & Economic Growth, Bureau of Construction Codes

NOTICE OF HEARING

Date: August 3, 2007
Time: 9:30 a.m.
Location: Department of Labor & Economic Growth, Bureau of Construction Codes
2501 Woodlake Circle, Okemos, Michigan 48864

Pursuant to the authority contained in Rule 338.1005a General Administrative Board Rules.

A Hearing will be held in response to the request of Randal E. Cole, 1655 Parkway, Muskegon, MI 49442, to sit for the journey electrician examination.

MICHIGAN STATE ELECTRICAL ADMINISTRATIVE BOARD

Virgil Monroe, Chief of Electrical Division

July 19, 2007
Date

JENNIFER M. GRANHOLM
GOVERNOR

STATE OF MICHIGAN
DEPARTMENT OF LABOR & ECONOMIC GROWTH
LANSING

KEITH W. COOLEY
DIRECTOR

August 3, 2007

E-07-15

TO: Members of the State Electrical Administrative Board

FROM: Virgil Monroe, Chief, Electrical Division

SUBJECT: Appeal by Randal E. Cole to take the journey electrician exam.

APPLICANT REPRESENTATIVE:

Randal E. Cole

PROJECT:

Not applicable.

AUTHORITY:

The Michigan Electrical Administrative Act of 1956 as Amended, being Act 217 of the Michigan Compiled Laws.

REQUEST:

Requesting an appeal to sit for the journeyman electrician examination.

APPLICABLE RULE:

338.881 Sec. 1. (6), 338.883 Sec. 3. (7), 338.883e Sec. 3e. (1), and 338.1039a

FINDINGS:

Mr. Cole's former employer, Challenge Machinery Company, does not possess an electrical affidavit. Either an electrical contractor or his qualifying master, or the qualifying master of an affidavit holder must sign verification of hours of experience. Alan Freeman is the master of his own electrical contracting company, Freeman Electric. Therefore, he cannot verify work experience for employee's of Challenge Machinery Company and the hours Mr. Cole accumulated (7,800) at Challenge Machinery Company cannot be credited towards the 8000 hour minimum requirement for the journeyman examination.

RECOMMENDATION:

Staff recommends denial of the appeal until Mr. Cole satisfies the requirements of the Act and the rules.

MUSKEGON COUNTY
M I C H I G A N

July 10, 2007

Electrical Administrative Board
DLEG/BCC/Electrical Division
P.O. Box 30254
Lansing, MI 48909

Dear Board Members:

Please find attached a copy of the application that our Apprentice Electrician, Randy Cole, sent to your office for consideration in taking the Journeyman Electrician's exam. We received a letter from the State Electrical Division declining his application for two reasons (see attached letter). The first reason given was that apparently the company Randy worked for did not have an affidavit on file, and, therefore, Randy could not count those hours. This is a huge setback for Randy and the Muskegon County Wastewater System. We honestly believed that Randy met the intent of the law and was trained properly through his work experience with Master Electrician Alan Freeman. We invested much time and training based upon Randy being qualified to sit for this exam in a year. We have a great deal of electrical work in our Wastewater collection and treatment systems and need for him to have the opportunity to work independently as a Journeyman Electrician. Randy was initially trained as a irrigation rig technician and his knowledge of this equipment's mechanical, hydraulic, and electrical systems is extensive. To have him under constant supervision from the Master Electrician to do electrical work on these irrigation systems seems redundant.

The second reason given in the letter was that Randy did not provide the correct documentation showing his work experience. With all due respect, Randy did provide documentation showing 7900 hours of electrical work he performed under Master Electrician Alan Freeman. This was documented and notarized per requirements of the state (also see attached).

The County would like to present its case at the August Electrical Administrative Board meeting. The representatives from the County that will ask to speak, if permitted, are Harry Sloop (Wastewater System Master Electrician), Mike Barry (Randy's Supervisor), Randy Cole (Applicant) and myself (Mark Eisenbarth - Deputy Director of Public Works for Wastewater).

WASTEWATER MANAGEMENT SYSTEM • 8301 WHITE ROAD • MUSKEGON, MI 49442
(231) 724-3440 • FAX (231) 724-3588

Thank you for letting us participate in the process, and we look forward to meeting with you.

Sincerely,

Mark Eisenbarth
Deputy Director of Public Works for Wastewater
8301 White Road Muskegon, MI 49442

JENNIFER M. GRANHOLM
GOVERNOR

STATE OF MICHIGAN
DEPARTMENT OF LABOR & ECONOMIC GROWTH
LANSING

KEITH W. COOLEY
DIRECTOR

RECEIVED
JUL 17 2007
By

June 11, 2007

Mr. Randal E. Cole
1655 Parkway
Muskegon, MI 49442

Dear Mr. Cole:

Your application for the **June** electrical examination cannot be approved for the following reason(s):

1. **Your verification letter of experience from Challenge Machining Co. did not indicate proper licensed supervision. Alan Freeman is the master of record for Freeman Electric. Challenge Machining Company does not have an affidavit on file with our office. Your hours from Challenge Machining Company do not count towards your 8000 hours.**

2. **The Electrical Administrative Act, PA 217 of 1956 requires apprentices to register with the State of Michigan (or a local licensing authority) to perform electrical work. Strict enforcement of a four-year apprentice registration requirement began January 1, 2004.**

   Since you have not been a registered apprentice for four years, to qualify to take the journeymen electrician examination you must comply with these alternative requirements approved by the Electrical Administrative Board on April 2, 2004.

   Documentation of participation in a structured apprenticeship program during this four-year period, OR, a letter of progression must be provided by your employer showing your work experience (see attached information sheet) from NEW/ENTRY level worker to SKILLED worker. (Muskegon County Michigan)

   Your letters of documentation are being returned to you for your safekeeping.

Return a copy of this letter to **PO Box 30255, Lansing, MI 48909** and any response required by **June 26, 2007** to be eligible for the **October** examination.

If you are unable to provide the additional information requested you will be ineligible for the examination and any fees paid will be forfeited as outlined in Rule 338.1002a of the General Electrical Administrative Board Rules.

Please contact the Electrical Division at 517-241-9320 if you have any questions.

Sincerely,

Evie Livingston, Departmental Technician
Electrical Division

EL/ao

BELOW IS THE REQUIRED INFORMATION NEEDED FOR A LETTER OF PROGRESSION FROM AN EMPLOYER.

- Document must be original
- On company letterhead
- Name of examination applicant (apprentice)
- Beginning date (month, day and year) and ending date (month, day and year) of employment
- Total number of hours worked (not including overtime)
- Progression from entry level to skilled worker in electrical, year 1, year 2, year 3, year 4, showing the electrical work the applicant installed under the supervision of a master (i.e. Pulled wires, bent conduit, etc), not construction type (commercial, residential, etc.) Or, provide documentation of your completion of a structured electrical apprenticeship program.
- Name and license number of the journey or master electrician that supervised the applicant
- Signed by the master or contractor of record
- Documentation must be notarized

(Note: If this letter contains all the information listed above, it can be used for both the progression letter and the verification of time letter.)

Effective September 1, 2006 all journeyman electrical examination applications must document at least 2 years of apprentice registration with the State of Michigan: beginning on September 1, 2007, all journeyman electrical examination applicants must document at least 3 years of apprentice registration with the State of Michigan: and beginning on September 1, 2008, all journeyman electrical examination applicants must document four years of apprentice registration with the State of Michigan along with the experience requirements as outlined in the act and rules

Alan Freeman
15002 Thoroughbred Run
Spring Lake, MI 49456
616-842-1498

September 23, 2004

To Whom It May Concern:

This letter is to inform you that Randy Cole worked under my supervision for 5 years during his employment at Challenge Machinery Company in Grand Haven, Michigan. Randy worked in the maintenance department, with his main responsibilities being various electrical duties. During this time I would estimate that Randy's experience in the electrical field would be approximately 75 percent, totaling 7,800 hours.

If you have any questions or concerns, I can be reached at the above address or phone number.

Sincerely,

Alan E Freeman

Alan Freeman
Master Electrician

Freeman Electric
ELECTRICAL CONTRACTING
15002 Thoroughbred Run
(616) 842-1498

MASTER LIC. #62-00221
OWNER ALAN FREEMAN
CONTR. LIC. #61-00151

CHALLENGE MACHINERY COMPANY
GRAND HAVEN MICHIGAN

EMPLOYEE: RANDAL E. COLE
EMPLOYMENT DATE STARTED: 07/01/1977
EMPLOYMENT DATE ENDED: 03/03/2000

YEAR: 1987

Description of work:	
Electrical Component Assembly	160
Control Panel Troubleshooting	250
Conduit & wiring Installation for new/used machinery	180
Conduit Installation	340
Installation of safety circuits G.F.I.C	190
Telephone & PA Systems Wiring & Hook-up	480
Hours:	1,600

YEAR: 1988

Description of work:	
Wire Harness Assembly	320
Installation of safety circuits G.F.I.C	185
Electrical Component Assembly	120
Control Panel Troubleshooting	345
Conduit & wiring Installation for new/used machinery	620
Installing wiring for work stations 120v, 240, 208 & 480.	420
Hours:	2,010

YEAR: 1989

Description of work:	
Telephone & PA Systems Wiring & Hook-up	200
Wiring Offices for lighting, computers, AC	350
Control Panel Troubleshooting	340
Control Panel Troubleshooting	350
Conduit & wiring Installation for new/used machinery	410
Conduit Installation	350
Hours:	2,000

YEAR: 1990

Description of work:	
Installing Breaker Boxes	184
Conduit & wiring Installation for new/used machinery	306
Wiring Offices for lighting, computers, AC	360
Conduit Installation	340
Control Panel Troubleshooting	364
Electrical Component Assembly	200
Single Phase & 3 Phase circuitry troubleshooting & problem solving	306
Hours:	2,060

YEAR: 1991

Description of work:		
	Single Phase & 3 Phase circuitry troubleshooting & problem solving	100
	Installing Breaker Boxes	25
	Wiring harness assembly	25
	Control Panel Troubleshooting	80
	Hours:	230
	Total Hours	7,900

SIGNATURE OF SUPERVISOR OF CHALLENGE MACHINERY CO.

I certify the information provided is true and accurate to the best of my ability.	
Signature of supervisor: Alan E Freeman	Date: 12/21/2005
PRINT NAME: ALAN E FREEMAN	

CERTIFICATION AND SIGNATUE OF SUPERVISOR MASTER ELECTICIAN

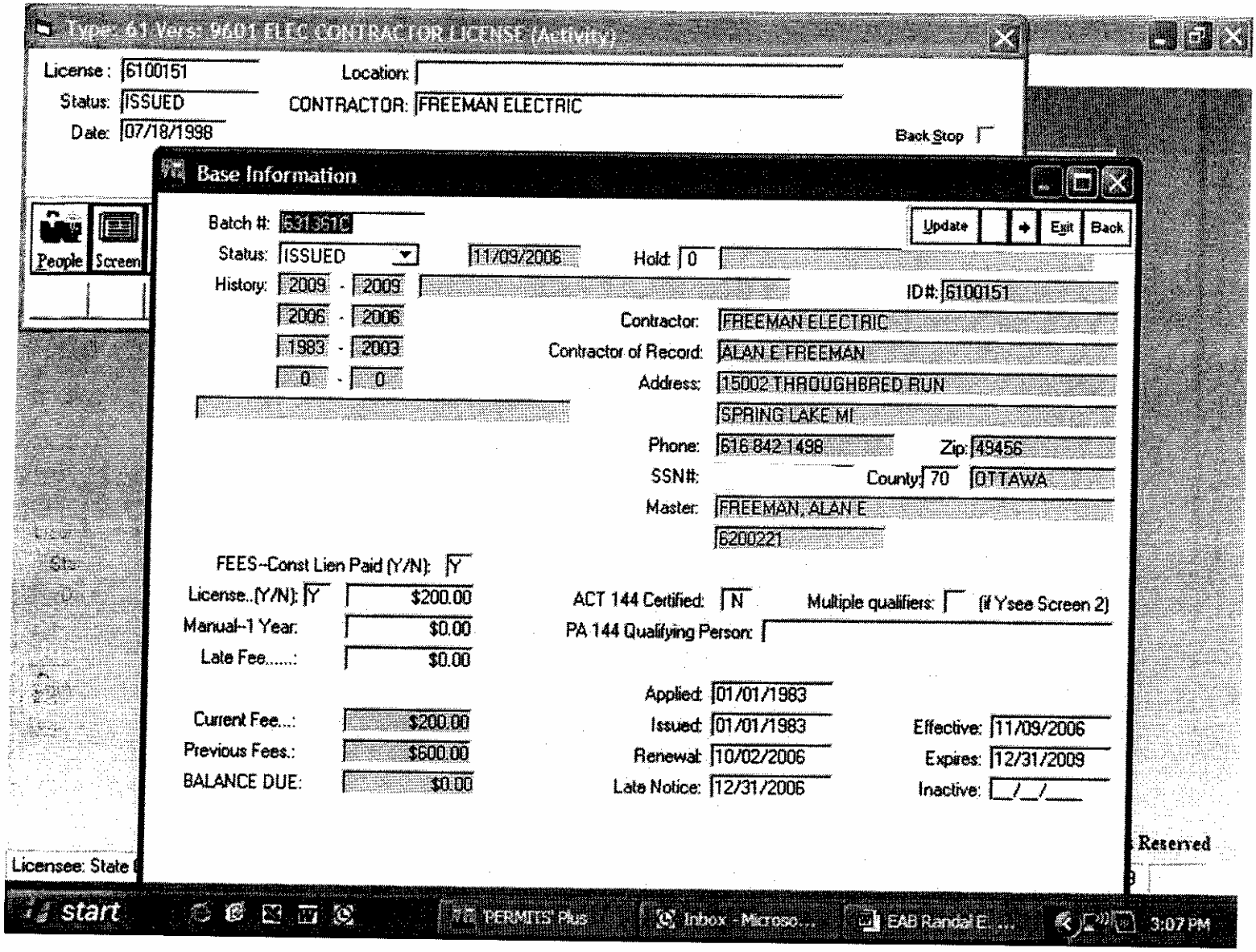
I certify the information provided is true and accurate to the best of my ability.	
Signature of supervisor: Alan E Freeman	Master License NO. 62-00221
ALAN FREEMAN	

subscribed and sworn before me, this 21st Day of December 2005, Henni A. Campbell, a Notary Public in and for Ottawa County, Michigan.

Henni A. Campbell
(Signature of Notary Public)

HENNI A. CAMPBELL
NOTARY PUBLIC, STATE OF MICHIGAN
OTTAWA COUNTY
MY COMMISSION EXPIRES JAN. 11, 2007

My Commission expires: January 11, 2007.


Type: 61 Vers: 9601 ELEC CONTRACTOR LICENSE (Activity)
License : 6100151
Location:
Status: ISSUED
CONTRACTOR: FREEMAN ELECTRIC
Date: 07/18/1998
Back Stop
People
Screen
Base Information
Batch #: 5315616
Update
Exit
Back
Status: ISSUED
11/09/2006
Hold: 0
History: 2009 - 2009
2006 - 2006
1983 - 2003
0 - 0
ID#: 6100151
Contractor: FREEMAN ELECTRIC
Contractor of Record: ALAN E FREEMAN
Address: 15002 THROUGHBRED RUN
SPRING LAKE MI
Phone: 616 842 1498
Zip: 49456
SSN#:
County: 70 OTTAWA
Master: FREEMAN, ALAN E
6200221
FEES--Const Lien Paid (Y/N): Y
License..(Y/N): Y $200.00
Manual--1 Year: $0.00
Late Fee.....: $0.00
ACT 144 Certified: N
Multiple qualifiers: (if Y see Screen 2)
PA 144 Qualifying Person:
Current Fee...: $200.00
Previous Fees.: $600.00
BALANCE DUE: $0.00
Applied: 01/01/1983
Issued: 01/01/1983
Renewal: 10/02/2006
Late Notice: 12/31/2006
Effective: 11/09/2006
Expires: 12/31/2009
Inactive: __/__/____
Licensee: State
Reserved
start
PERMITS Plus
Inbox - Microso...
EAB Randal E ...
3:07 PM

JENNIFER M. GRANHOLM
GOVERNOR

STATE OF MICHIGAN
DEPARTMENT OF LABOR & ECONOMIC GROWTH
LANSING

KEITH W. COOLEY
DIRECTOR

June 11, 2007

Mr. Randal E. Cole
1655 Parkway
Muskegon, MI 49442

Dear Mr. Cole:

Your application for the **June** electrical examination cannot be approved for the following reason(s):

1. **Your verification letter of experience from Challenge Machining Co. did not indicate proper licensed supervision. Alan Freeman is the master of record for Freeman Electric. Challenge Machining Company does not have an affidavit on file with our office. Your hours from Challenge Machining Company do not count towards your 8000 hours.**

2. **The Electrical Administrative Act, PA 217 of 1956 requires apprentices to register with the State of Michigan (or a local licensing authority) to perform electrical work. Strict enforcement of a four-year apprentice registration requirement began January 1, 2004.**

   Since you have not been a registered apprentice for four years, to qualify to take the journeymen electrician examination you must comply with these alternative requirements approved by the Electrical Administrative Board on April 2, 2004.

   Documentation of participation in a structured apprenticeship program during this four-year period, OR, a letter of progression must be provided by your employer showing your work experience (see attached information sheet) from NEW/ENTRY level worker to SKILLED worker. (Muskegon County Michigan)

   Your letters of documentation are being returned to you for your safekeeping.

Return a copy of this letter to **PO Box 30255, Lansing, MI 48909** and any response required by **June 26, 2007** to be eligible for the **October** examination.

If you are unable to provide the additional information requested you will be ineligible for the examination and any fees paid will be forfeited as outlined in Rule 338.1002a of the General Electrical Administrative Board Rules.

Please contact the Electrical Division at 517-241-9320 if you have any questions.

Sincerely,

Evie Livingston

Evie Livingston, Departmental Technician
Electrical Division

EL/ao

Returned Docs
6/12/07

EXAM APPLICATION REVIEW RECORD

PAGE ____ OF ____

Applicant Name:	Kunkel & Cole	DATE: 5/17/07
Reviewer Name:	Eric	
TYPE OF REVIEW:	☑ Journeyman Electrician ☐ Master Electrician	☐ Electrical Contractor
	☐ Fire Alarm Technician ☐ Sign Specialty	☐
STATUS:	☐ APPROVED	☑ NOT APPROVED

REVIEW COMMENTS:

ITEM NO:	MACRO	ENTER COMMENTS IF THERE IS NO MACRO OR IF YOU NEED TO ADD ADDITIONAL COMMENTS TO A MACRO
1.		Your verification letter of experience from Challenge Machinery Co. did not indicate proper licensed supervision. Alan Freeman is the master record for Freeman Electric. Challenge Machinery Company does not have an affidavit on file with our office. Your hours ~~were not~~ from Challenge Machinery Company do ~~does~~ not count towards your 8000 hours. 29,290 Muskegon County Michigan ~~Your letters of documentation are being returned to you for your safekeeping~~. Your letters of documentation are being returned to you for your safekeeping. An application that is denied

1) Back-payment of registration fees: Total fees due. $_____

2) Registration Documentation:

a- Apprentice Registration on file: YES ____ NO ____
(If NO, an apprentice registration application is enclosed. If YES, no additional response is required)

b- Registration is current: YES ____ NO ____
(If NO, a renewal card is enclosed. If YES, no additional response is required.)

3) Structured apprenticeship program: YES ____ NO ____
(If NO , return an original, notarized letter from your employer, on company letterhead, stating the training progression of your apprenticeship from new

orig

Application for Journeyman Electrician Examination

Michigan Department of Labor & Economic Growth
Bureau of Construction Codes / Electrical Division
P.O. Box 30255, Lansing, MI 48909
517-241-9320
www.michigan.gov/bcc

RECEIVED
MAY 0 8 2007
By _____ Agency use only

103

6333282

Examination Fee: $25.00 (non-refundable)

Authority: 1956 PA 217 Completion: Mandatory Penalty: Examination will not be given	The Department of Labor and Economic Growth will not discriminate against any individual or group because of race, sex, religion, age, national origin, color, marital status, disability, or political beliefs. If you need help with reading, writing, hearing, etc., under the Americans with Disabilities Act, you may make your needs known to this agency.

Instructions: To be eligible to make application for and take this examination an applicant shall meet the following criteria:

- Complete and sign application. Type or print in ink.
- Application and fee must be received 20 business days prior to the examination date.
- Applicant must not be less than 20 years of age.
- Provide ***original notarized*** documentation from present or former employers to the effect that the applicant has not less than 8,000 hours of practical experience obtained over a period of not less than 4 years related to electrical construction or electrical maintenance of buildings under direct supervision of a person licensed pursuant to the act. Documentation must include the beginning (month, day, year) to ending (month, day, year) dates of employment. The 8,000 hours of practical work experience over 4 years must be attained prior to the deadline date for submitting documentation. ***Notarized***, original documentation must be on employers' letterhead stationery and provide dates of employment and hours worked under licensed supervision and signed by the qualified master electrician.
- Provide **proof of registration** as an electrical apprentice for not less than 4 years.
- Enclose a check made payable to the **State of Michigan**.
- Mail completed application, appropriate documentation and fee to address above.

Information

Applicants are permitted one examination for the $25.00 fee. Upon achieving a minimum passing score of 75% or higher, the applicant will be billed $20.00 for the journeyman electrician license prior to issuance of the license. Failure of examination 2 times within 2 years requires 1 year waiting period from the date of the second failure and proof of successful completion of a course on code, electrical fundamentals or theory to be eligible for reexamination. Examination fee is forfeited upon failure to appear for scheduled examination unless written explanation is received within 10 business days of the examination.

Examination Eligibility of Applicants From Other States or Countries

A person who is licensed as a journeyman electrician in another state or country may qualify for examination upon determination by the board that the license was obtained by the person through substantially the same or equal requirements as those of the state of Michigan in accordance with the provisions of section 3a of the act.

Applicant Information

NAME (Last Name, First Name, Middle Initial)	APPRENTICE REGISTRATION NUMBER	DATE OF BIRTH
Cole Randal E.	6420493	
ADDRESS	**CITY**	**TOWNSHIP**
1655 Parkway	Muskegon	Egelston
COUNTY	**STATE**	**ZIP CODE**
Muskegon	Michigan	49442

Have you previously taken this examination? ☐ Yes ☒ No

If examination was not administered by the State Electrical Division provide the licensing entity:

City of _____ Township of _____

Examination Site

Examinations are given at the sites listed below. Refer to the enclosed "Schedule of Electrical Board Meetings and Licensing Examinations" for examination dates. Please check below the site you wish to be examined at and indicate a preference of examination month. If approved for examination, an admission card will be mailed to you approximately 10 days prior to the examination date. If the examination you have selected is full, you will be scheduled for the next available examination at your preferred site.

Preferred Site	Preferred Month	
☒ Lansing	June	☐ No Preference - Next Available Examination Site and Date
☐ Escanaba		

If you have a disability and require an accommodation to take the examination, please submit written documentation from a professional (education professional, doctor, psychologist, psychiatrist) to certify that your disabling condition requires the requested test accommodation. Forms are available from this office.

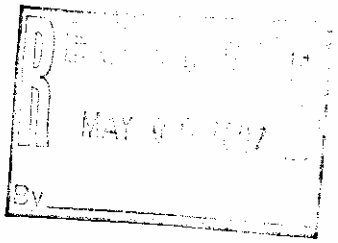
Experience Record

NAME OF CURRENT EMPLOYER		DATES OF EMPLOYMENT (MM/DD/YY)		
Muskegon County Wastewater		BEGINNING May 7, 2000	ENDING	
ADDRESS	CITY	STATE	ZIP CODE	
8301 White Rd.	Muskegon	Michigan	49442	
TYPE OF WORK PERFORMED				
Irrigation Rig Maintenance- Electrician Apprentice.				
NAME OF EMPLOYER		DATES OF EMPLOYMENT (MM/DD/YY)		
The Challenge Machinery Co.		BEGINNING July 7, 1977	ENDING May 6, 2000	
ADDRESS	CITY	STATE	ZIP CODE	
1433 Fulton	Grand Haven	Mi.	49417	
TYPE OF WORK PERFORMED				
Machine and electrical maintenance. Machine Operator.				
NAME OF EMPLOYER		DATES OF EMPLOYMENT (MM/DD/YY)		
		BEGINNING	ENDING	
ADDRESS	CITY	STATE	ZIP CODE	
TYPE OF WORK PERFORMED				
NAME OF EMPLOYER		DATES OF EMPLOYMENT (MM/DD/YY)		
		BEGINNING	ENDING	
ADDRESS	CITY	STATE	ZIP CODE	
TYPE OF WORK PERFORMED				

Certification and Signature

I certify the information provided is true and accurate to the best of my ability and I have the experience required for this examination. I further understand falsification of any statement is cause for rejection of this application or revocation of license, if issued.

APPLICANT'S SIGNATURE	DATE
Randal E. Cole	5-2-2007



Agency Use Only

Approved for Exam ☐ Yes ☐ No

Date of Exam	Score	Absent	Date of Exam	Score	Absent

Validation Area

Tran Info:103 12909364-1 05/08/07
Chk#: 2980 Amt: $25.00
ID: RANDAL E COLE

Date Approved by EAB _____

MUSKEGON COUNTY
M I C H I G A N

Harry Sloop
MCWMS
8301 White Road
Muskegon, MI 49442
(231) 724-3440

May 3, 2007

To Electrical Review Board:

This letter is to inform you that Randal E. Cole worked under my supervision since August 15, 2005. We work for the Muskegon County Wastewater Management System. Randal is assigned to the Operations Maintenance Department. He is a registered Apprentice. His duties being various electrical assignments during this time. Randal has accrued 2,845 hours. With these hours and his educational training and previous experience he has over 8,000 hours.

If you have any questions or concerns, I can be reached at the above address or phone number.

Sincerely,

Harry Sloop
Master Electrician #6208362
Electrical Affidavit #6500297

Signed before me this 3rd day of May 2007 by Harry Sloop as verified by his Michigan drivers license.

JOAN J. RAAP
Notary Public, Muskegon County, Michigan
My Commission Expires: 2-08-2014

Muskegon County Wastewater Management System
Muskegon, Michigan

EMPLOYEE: RANDAL E. COLE
EMPLOYMENT DATE STARTED: 05/08/2000
EMPLOYMENT DATE ENDED: 08/15/2005

YEAR: 2005

Description of work:		
	Control Panel Troubleshooting	310
	Installation of Circuits	220
	Conduit & Wiring	235
	Hours:	765

YEAR: 2006

Description of work:		
	AC Drive Repairs	400
	Electrical Drive PM's	206
	Electrical Troubleshooting	390
	Installation of Circuits	360
	Conduit and Wiring Installation	724
	Hours:	2,080

Application for Journeyman Electrician Examination

Michigan Department of Labor & Economic Growth
Bureau of Construction Codes / Electrical Division
P.O. Box 30255, Lansing, MI 48909
517-241-9320
www.michigan.gov/bcc

JUL 17 2007
Agency Use Only
By

Examination Fee: $25.00 (non-refundable)

Authority: 1956 PA 217 Completion: Mandatory Penalty: Examination will not be given	The Department of Labor and Economic Growth will not discriminate against any individual or group because of race, sex, religion, age, national origin, color, marital status, disability, or political beliefs. If you need help with reading, writing, hearing, etc., under the Americans with Disabilities Act, you may make your needs known to this agency.

Instructions: To be eligible to make application for and take this examination an applicant shall meet the following criteria:

- Complete and sign application. Type or print in ink.
- Application and fee must be received 20 business days prior to the examination date.
- Applicant must not be less than 20 years of age.
- Provide ***original notarized*** documentation from present or former employers to the effect that the applicant has not less than 8,000 hours of practical experience obtained over a period of not less than 4 years related to electrical construction or electrical maintenance of buildings under direct supervision of a person licensed pursuant to the act. Documentation must include the beginning (month, day, year) to ending (month, day, year) dates of employment. The 8,000 hours of practical work experience over 4 years must be attained prior to the deadline date for submitting documentation. ***Notarized***, original documentation must be on employers' letterhead stationery and provide dates of employment and hours worked under licensed supervision and signed by the qualified master electrician.
- Provide **proof of registration** as an electrical apprentice for not less than 4 years.
- Enclose a check made payable to the **State of Michigan**.
- Mail completed application, appropriate documentation and fee to address above.

Information

Applicants are permitted one examination for the $25.00 fee. Upon achieving a minimum passing score of 75% or higher, the applicant will be billed $20.00 for the journeyman electrician license prior to issuance of the license. Failure of examination 2 times within 2 years requires 1 year waiting period from the date of the second failure and proof of successful completion of a course on code, electrical fundamentals or theory to be eligible for reexamination. Examination fee is forfeited upon failure to appear for scheduled examination unless written explanation is received within 10 business days of the examination.

Examination Eligibility of Applicants From Other States or Countries

A person who is licensed as a journeyman electrician in another state or country may qualify for examination upon determination by the board that the license was obtained by the person through substantially the same or equal requirements as those of the state of Michigan in accordance with the provisions of section 3a of the act.

Applicant Information

NAME (Last Name, First Name, Middle Initial)	APPRENTICE REGISTRATION NUMBER	DATE
Cole Randal E.		
ADDRESS	**CITY**	**TOWNSHIP**
1655 Parkway	Muskegon	Egelston
COUNTY	**STATE**	**ZIP CODE** / **TELEPHONE NUMBER**
Muskegon	Michigan	49442

Have you previously taken this examination? ☐ Yes ☒ No

If examination was not administered by the State Electrical Division provide the licensing entity:

City of _____ Township of _____

Examination Site

Examinations are given at the sites listed below. Refer to the enclosed "Schedule of Electrical Board Meetings and Licensing Examinations" for examination dates. Please check below the site you wish to be examined at and indicate a preference of examination month. If approved for examination, an admission card will be mailed to you approximately 10 days prior to the examination date. If the examination you have selected is full, you will be scheduled for the next available examination at your preferred site.

Preferred Site	Preferred Month
☒ Lansing	June
☐ Escanaba	

☐ No Preference - Next Available Examination Site and Date

If you have a disability and require an accommodation to take the examination, please submit written documentation from a professional (education professional, doctor, psychologist, psychiatrist) to certify that your disabling condition requires the requested test accommodation. Forms are available from this office.

*This information is confidential. Disclosure of confidential information is protected by the Federal Privacy Act.

Experience Record

NAME OF CURRENT EMPLOYER		DATES OF EMPLOYMENT (MM/DD/YY)	
Muskegon County Wastewater		BEGINNING May 7, 2000	ENDING
ADDRESS	**CITY**	**STATE**	**ZIP CODE**
8301 White Rd.	Muskegon	Michigan	49442
TYPE OF WORK PERFORMED			
Irrigation Rig Maintenance-Electrician Apprentice.			

NAME OF EMPLOYER		DATES OF EMPLOYMENT (MM/DD/YY)	
The Challenge Machinery Co.		BEGINNING July 7, 1977	ENDING May 6, 2000
ADDRESS	**CITY**	**STATE**	**ZIP CODE**
1433 Fulton	Grand Haven	Mi.	49417
TYPE OF WORK PERFORMED			
Machine and electrical maintenance. Machine Operator.			

NAME OF EMPLOYER		DATES OF EMPLOYMENT (MM/DD/YY)	
		BEGINNING:	ENDING:
ADDRESS	**CITY**	**STATE**	**ZIP CODE**
TYPE OF WORK PERFORMED			

NAME OF EMPLOYER		DATES OF EMPLOYMENT (MM/DD/YY)	
		BEGINNING:	ENDING:
ADDRESS	**CITY**	**STATE**	**ZIP CODE**
TYPE OF WORK PERFORMED			

Certification and Signature

I certify the information provided is true and accurate to the best of my ability and I have the experience required for this examination. I further understand falsification of any statement is cause for rejection of this application or revocation of license, if issued.

APPLICANT'S SIGNATURE	DATE
Randall E. Cole	5-2-2007

Agency Use Only

Approved for Exam ☐ Yes ☐ No

Date of Exam	Score	Absent	Date of Exam	Score	Absent

Validation Area

Date Approved by EAB _____

Muskegon Community College

221 South Quarterline Road • Muskegon Michigan 49442 • (231) 773-9131

RECEIVED
JUL 17 2007
By

844 00069
COLE RANDAL E
1655 PARKWAY
MUSKEGON MI 49442

MCC No. 771740
ACADEMIC STATUS:
PROBATION
DATE PRINTED: 6/29/2006

SPRING 2006 GRADE REPORT

COURSE ID	DESCRIPTION	SEM CR HOURS	GRADE
ELTC 152	NATIONAL ELECTRICAL CODE	3.0	B-

<SEM TOTS: EARNED 3.0 HR. GPA=2.700 ON 3.0 HRS.
>CUM TOTS: EARNED 9.0 HR. GPA=1.605 ON 20.0 HRS.
ACADEMIC STATUS: PROBATION
IMPORTANT:
Your cumulative GPA is below a 2.0. You are on academic probation. Please see a counselor before you sign up for another semester.

VOID

THE MARKING SYSTEM:

GP's*	Grade	
4	A	Excellent
3	B	Good
2	C	Average
1	D	Unsatisfactory

+ or – on above grades adjust grade point value up or down 0.3 points respectively

*Grade points per credit hour

DEGREE VALUES:

AA	Associate in Art
AS	Associate in Science
AAS	Associate in Applied Science
CERT	Certificate program completed
DIPLOMA	Other non-degree program

Area of study is indicated for the latter three.

THE FOLLOWING GRADES ARE NOT IN USED CALCULATING GPA (Grade Point Average):

I	Incomplete	WF	Withdrawal Failing	AU	Audit
P	Pass	WR	Withdrawal Repeat	CS	Community Service Credit
NP	No Pass	WI	Withdrawal Illness	NC	Community Service No Credit
W	Withdrawal	WA	Withdrawal Agreement	AP	Advanced Placement includes credit by exam and work experience
WP	Withdrawal Passing	WM	Withdrawal Military		

Muskegon Community College
221 South Quarterline Road • Muskegon Michigan 49442 • (231) 773-9131

2120 00139
COLE RANDAL E
1655 PARKWAY
MUSKEGON MI 49445

MCC No 771740
ACADEMIC STATUS: PROBATION
DATE PRINTED 12/22/2005

FALL 2005 GRADE REPORT

COURSE ID	DESCRIPTION	SEM CR HOURS	GRADE
ELTC 101	ELECTRICITY-BASIC	3.0	A

SEM UNITS EARNED 3.0 HR. GPA=4.000 ON 3.0 HRS.
CUM UNITS EARNED 3.0 HR. GPA=0.857 ON 14.0 HRS.
ACADEMIC STATUS: PROBATION
IMPORTANT:
Your cumulative GPA is below a 2.0. You are on academic probation. Please see a counselor before you sign up for another semester.

THE MARKING SYSTEM:

GP's*	Grade	
4	A	Excellent
3	B	Good
2	C	Average
1	D	Unsatisfactory

+ or – on above grades adjust grade point value up or down 0.3 points respectively

*Grade points per credit hour

DEGREE VALUES:

AA	Associate in Art
AS	Associate in Science
AAS	Associate in Applied Science
CERT	Certificate program completed
DIPLOMA	Other non-degree program

Area of study is indicated for the latter three.

THE FOLLOWING GRADES ARE NOT IN USED CALCULATING GPA (Grade Point Average):

I	Incomplete
P	Pass
NP	No Pass
W	Withdrawal
WP	Withdrawal Passing
WF	Withdrawal Failing
WR	Withdrawal Repeat
WI	Withdrawal Illness
WA	Withdrawal Agreement
WM	Withdrawal Military
AU	Audit
CS	Community Service Credit
NC	Community Service No Credit
AP	Advanced Placement includes credit by exam and work experience

Muskegon Community College

221 South Quarterline Road • Muskegon Michigan 49442 • (231) 773-9131

2032 [illegible] 00140
COLE RANDAL [illegible]
1655 PARKWAY [illegible]
MUSKEGON MI 49442

MCC No. 771740
ACADEMIC STATUS:
[illegible] PROBATION
DATE PRINTED 5/04/2006

WINTER 2006 GRADE REPORT

COURSE ID		DESCRIPTION	SEM CR HOURS	GRADE
ELTC	150	INDUSTRIAL ELECTRICITY	3.0	A

<SEM [illegible] EARNED 3.0 HR. GPA=4.000 ON 3.0 HRS.
>CUM [illegible] EARNED [illegible] HR. GPA=1.[illegible]12 ON 17[illegible] HRS.
ACADEMIC STATUS= PROBATION
IMPORTANT:
Your cumulative GPA is below a 2.0. You are on academic probation. Please see a counselor before you sign up for another semester.

THE MARKING SYSTEM:

GP's*	Grade	
4	A	Excellent
3	B	Good
2	C	Average
1	D	Unsatisfactory

+ or – on above grades adjust grade point value up or down 0.3 points respectively

*Grade points per credit hour

DEGREE VALUES:

AA	Associate in Art
AS	Associate in Science
AAS	Associate in Applied Science
CERT	Certificate program completed
DIPLOMA	Other non-degree program

Area of study is indicated for the latter three.

THE FOLLOWING GRADES ARE NOT IN USED CALCULATING GPA (Grade Point Average):

I	Incomplete	WF	Withdrawal Failing	AU	Audit
P	Pass	WR	Withdrawal Repeat	CS	Community Service Credit
NP	No Pass	WI	Withdrawal Illness	NC	Community Service No Credit